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List of Abbreviations

AAU	University of Ålborg
CAPEX	Capital expense
DoW	Description of Work
DTU	Technical University of Denmark
ECOWindS	European Clusters for Offshore Wind Servicing
EERA	European Energy Research Alliance
ERDF	European Union Regional Development Fund
ESF	European Union Social Fund
EWEA	European Wind Energy Association
GW	germanwind GmbH
H2020	Horizon 2020 – The Framework Programme for Research and Innovation
JAP	Joint Action Plan
LCoE	Levelised Cost of Energy
OEDK	Offshoreenergy.dk
OEM	Original Equipment Manufacturer
OEUK	Orbis Energy (United Kingdom)
OH&S	Occupational Health and Safety
O&M	Operations and Maintenance
OPEX	Operating expense
OWS	Offshore Wind Services
RDC	Research Driven Cluster
RDI	Research, Development and Innovation
R&D	Research & Development
SET-Plan	The European Strategic Energy Technology Plan

SOR	Strategic Orientation
SWOT	Strengths, Weaknesses, Opportunities, Threats
TPWind	European Technology Platform on Wind Energy
WP	Work Package
ÅUC	Ålesund University College

Executive Summary

Introduction

The Joint Action Plan (JAP) is a deliverable of the European Clusters for Offshore Wind Servicing (ECOWindS) project Work Package 4 (WP4) “Joint Action Plan”. It presents a plan of action or a roadmap for research, development, and innovation (RDI) for the Offshore Wind Service (OWS) industry. The objective of the JAP is to be an international, cross-regional, agenda for research, development and innovation specifically for Offshore Wind *Services*.

OWS is a key industry that is very important to financial and technical sustainability of the rapidly expanding Offshore Wind industry. The JAP is an agenda for collaboration aimed to develop new and improved OWS business models, technologies and other concepts in support of general offshore wind cost reduction targets. The audience of the JAP is threefold, it includes offshore wind industry constituents, research institutions and policy makers who set the framework conditions for OWS.

The JAP is a complement to other research agendas on wind power presented or under development by other organizations by approaching the challenges of offshore wind from the *service perspective*. To mention examples of other strategies and roadmaps complemented by the JAP, the European Wind Energy Technology Platform (TPWind 2014a) has presented a Strategic Research Agenda / Market Deployment Strategy (TPWind 2014b) in March 2014 , the European Energy Research Alliance (EERA) Joint Programme on Wind Energy (EERA 2014) has been running since 2010, the current JP Wind Strategy covers the period 2014-2030, and the meso level Strategic Action Plan 2014-2017. These collaborations and the strategies focus on a broad front of technology related to the wind turbines, electric infrastructure, grid integration etc., while the ECOWindS JAP explicitly and specifically focuses on the services for offshore wind farm installation, operation and maintenance.

The JAP is a result of an intensive collaboration between the project partners. The process has been structured by Technical University of Denmark (DTU) while other partners have made contributions to the organization of the process and the content. Following the logical flow of the project, the JAP is built on the analysis and strategy development from the first three work packages of ECOWindS. Building on this framework, the core of the JAP was a participatory JAP workshop March 10th 2014. The workshop was held at the European Wind Energy Association (EWEA) Annual Event 2014 together with ECOWindS Midway conference. A broad group of stakeholders from the triple helix, altogether 31 participants, from the four regions were present at the workshop, comprising representatives from organisations for R&D and education, policy makers and offshore wind industry.

Overview to the Joint Action Plan

The vision associated with the JAP is that by 2020 OWS is a recognized industry with strong networks around the Globe and especially the North Sea. By that time the installed offshore wind capacity has multiplied, and as a consequence of the industrialisation and purposeful RDI and standardization efforts, the key components have been standardised to an extent that enables smooth installation, interoperability between components, and efficient O&M services.

At the heart of this fruitful progress are strong networks and confidential relationships along the value chain that enable optimizing the delivery of value through the whole life cycle of the wind farm from the factory door to end of life. These networks involve the key stakeholders from operators and developers to turbine and grid component manufacturers, load handling and hauling enterprises who handle the components, to the offshore service enterprises who install and maintain the farms when installed. Within the network everyone knows their added value and receives relevant information that enables them to continue to deliver value to the farm.

On top of this strong network lies a program of innovation and continuous improvement that drives all the stakeholders towards interoperability and standardisation on one hand, and bold innovation and experimentation on the other. This purposeful innovation program streamlines installation and O&M of the new farms to an extent that enables delivering cheap clean power reliably. Finally, as always, the success of OWS relies on a skilled and motivated workforce who can deliver value in every aspect of the value chain from research, development, engineering through transport to installation and O&M.

This Joint Action Plan is a portfolio that comprises 8 proposed actions, which can be divided into four parallel work streams - ‘coordination actions’, ‘research, development and innovation’, ‘harmonisation and standardisation’, and ‘skills and qualifications’ - which are support each other. The action themselves can be viewed as projects or programmes that make up a portfolio of OWS development. In the following overview, the actions are presented quite briefly. Each of the four work streams contributes to one or more sub goals set for the JAP, which together take OWS and offshore wind closer to the overall target of lowering LCoE 40% by 2020.

The central storyline of the JAP is that through development of inter-regional interconnections, the OWS enterprises gain complementary capabilities and are able to deliver new and improved services for the operators. At the same time the networking that creates closer business relations enables quicker and more candid feedback within the whole offshore wind ecosystem that enables standardization of components, processes and practices, which lays foundations for the continuous improvement of the OWS service delivery.

Following this logical framework, the first work stream of the proposed actions include three ‘coordination’ actions that build the necessary networks and social capital that is needed to achieve the major actions. The coordination work stream creates a basis for arguing the importance of, and driving support for OWS. It also serves to build the collaborative relations and consortia needed for effective goal-driven RDI that in itself contributes to the goal of establishing RDI to develop cost-reducing innovations. The third work stream builds on the previous ones and contributes both to technical standardisation and harmonisation of skills and qualifications. Last but not least, the fourth work stream directly contributes to skilled and qualified work force for OWS.

Building on the foundation of coordination the second work stream is ‘Research, Development and Innovation (RDI)’. The core of this stream is a research program for OWS. The key underlying theme within OWS specific RDI is the development of specific research

topics that complement the existing RDI that goes on in wind power and between the components of a wind farm and the service equipment.

The third work stream is 'harmonisation and standardisation'. The core action in this work stream is drive for OWS specific technical standards (Action 4) together with key original equipment manufacturers (OEMs). There are serious on-going efforts for standardization, not least the IEC TC88 on wind turbines and components. The objective of this action is not to supersede or replace existing efforts but to complement, provide added drive and introduce OWS specific topics and viewpoints to existing standards committees and processes, and secondarily set up new standards initiatives within existing frameworks as needed.

The fourth work stream is 'skills and qualifications' that relates strongly to harmonisation action on skills and training (Action 8). The aim of the sill work stream is to ensure that there is a skilled and qualified workforce to ensure efficient operation of offshore farms and by extension reliable delivery of power.

Implementation

The key to successful implementation of the JAP is to bridge existing national knowledge bases together and find complementary partnerships that are stronger together. The role of the ECOWindS project and consortium is to lay a foundation on certain actions and to act as a facilitator to form appropriate consortia to implement the actions. In general the assumption is that the JAP is managed by a post-ECOWindS collaboration, who will facilitate initiation of the actions and consortium building. The consortium members depend on the action. However, a general recommendation is to involve stakeholders along the value chain from OWS contractors, and suppliers through OEMs to operators. Incidentally these actions also serve as a platform for further collaboration towards the goals of the JAP and industry.

The general condition is to build a strong consortium for each action with the ability to implement it effectively and with the interest to drive it forwards. The latter essentially mean that from the start the consortium members for each action should be aligned in their interest towards the action. A key running theme in the JAP and the actions within it is that they aim to bridge national interests together, to enable cross border collaboration starting particularly around the North Sea and extending overseas as the industry goes. The rationale is to leverage the best capabilities to enable mutual learning across European regions. Further, international scope of the projects enables attracting a wider base of funding, as well as an impact.

Taking the actions together then, the bulk of the actions lay a strong foundation for the industry to push towards the goals. Thus the recommended and logical implementation order is:

- Starting from Actions 1 and 2, building a critical mass of interested stakeholders and to gather a momentum for the following actions
- Proceeding to ramp up a commonly agreed RDI program (Action 3) built on the JAP and ECOWindS WP6
- through to training programs (Action 5)
- and building up to OWS specific standardisation efforts (Action 4)

- Creating a database for OWS (Action 6), driving for occupational health and safety harmonisation (Action 8) and research infrastructures (Action 7) are important foundations for success of the other action in the long run.

Table of Contents

List of Abbreviations 3
Executive Summary 5
Table of Contents 9
1. Introduction 10
Presentation of ECOWindS and the consortium 10
Definition of Offshore Wind Services 12
Purpose and aim of JAP 15
JAP process 16
2. Strategic orientation of the OWS industry 18
Regional profiles 18
Strategic Orientation 19
3. Joint Action Plan 22
Position of the JAP 22
Overview to the actions 24
Flow of actions and timeline 26
4. Implementation guidelines 31
Priority of the actions 31
Financial plan 34
Overview to funding opportunities 34
Principles for mobilising the funding effectively 36
Dissemination plan 36
General principles 36
Target groups 38
Communication channels and media 39
5. Conclusion 41
References 46
ANNEX A: Detailed Actions 48

1. Introduction

The Joint Action Plan (JAP) and the associated Guidelines for Implementation are a deliverable of the ECOWindS project Work Package 4 (WP4) “Joint Action Plan”. The JAP itself presents a plan of action or a roadmap for research, development, and innovation (RDI) for the Offshore Wind Service (OWS) industry.

In this document, Guideline for Implementation (D4.2), elements of the implementation are interwoven with the JAP and specific actions, while some are discussed separately. The guidelines for implementation are specific guidelines to answer the question how can ECOWindS and the stakeholders effectively contribute to the realisation of these actions. The specific guidelines concern priority of the present and future actions, funding the actions and communicating the JAP to various stakeholders. The relationship of the JAP and other ECOWindS activities and the process for developing the JAP are detailed below.

The objective of the JAP is to be an international, cross-regional, agenda for research, development and innovation specifically for Offshore Wind *Services*. It has been recognized in the ECOWindS project that while there are several projects on various aspects of offshore wind in general, relatively little attention has been devoted to OWS specifically.

OWS is a key industry that is very important to financial and technical sustainability of the rapidly expanding Offshore Wind industry. The JAP is an agenda for collaboration aimed to develop new and improved OWS business models, technologies and other concepts in support of general offshore wind cost reduction targets. The audience of the JAP is threefold, it includes Offshore wind industry constituents, research institutions and policy makers who set the framework conditions for OWS.

The JAP is a result of an intensive collaboration between the project partners. The process has been structured by Technical University of Denmark (DTU) while other partners have made contributions to the organization of the process and the content. The process and position of the JAP is detailed below.

The elements of the Internationalisation Plan are endemic to the JAP. The underlying assumption in the actions is that they bring the regions together and bridge existing initiatives to support synergies between the regions. Thus the JAP can be considered an internationalisation plan from the perspective of the stakeholders.

Alongside the development of the JAP, an Evaluation and Adaptation Report (D4.3) has also been developed as a separate document, detailing a system for evaluating and updating the JAP.

Presentation of ECOWindS and the consortium

The overall goal of the ECOWindS project is to support development of the Offshore Wind Service industry (OWS) through stimulating research, development and innovation (RDI) in four Research Driven Clusters (RDCs) within key regions around the North Sea.

The vision of the ECOWindS Project is:

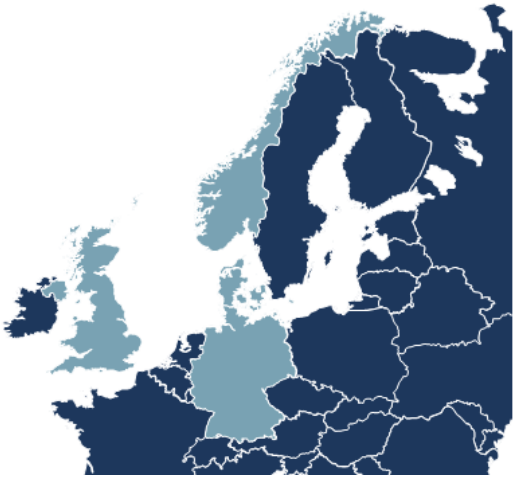
"*To pave the way for new research and understanding of how the costs of offshore wind servicing can be driven down through research, innovation and cross regional cooperation.* "

The project objectives are to:

- Increase capacity for innovation amongst and within ECOWindS Research Driven Cluster (RDC)
- Develop regional strategies for Offshore Wind Servicing (OWS), via smart specialisation, which are integrated in a inter-regional Joint Action Plan (JAP)
- Develop an international cooperation strategy for innovative OWS clusters to internationalise and exploit new business opportunities
- Increase innovation driven cooperation of stakeholders (authorities, research entities and local business communities) within and amongst the participating clusters by means of regional research agendas and a joint action plan
- Improve qualification capacities within and amongst the RDCs to secure a capable workforce and intelligent researchers that respond to the needs of the OWS sector across Europe and internationally.

The partner regions, or Research Driven Clusters (RDCs), of ECOWindS are:

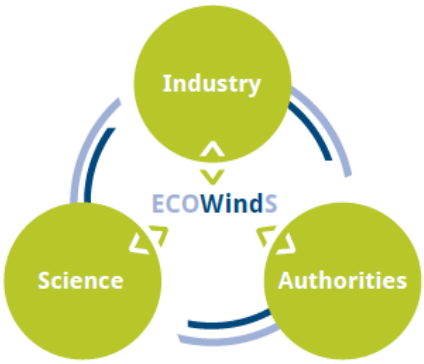
- South Denmark (Region Syddanmark Southern Jutland),
- East of England (Counties of Cambridge, Suffolk, Norfolk, Hertfordshire, Essex, and Bedfordshire),
- North West Germany (Bremen-Bremerhaven region, federal states [Bundesländer] of Bremen, Hamburg, and Niedersachsen, and as an extended region Schleswig-Holstein, Mecklenburg-Vorpommern and Nordrhein-Westfalen)
- Møre in West Norway.



The rationale behind bringing them together in the ECOWindS project can be summarised in:

- They have national and/or regional business development strategies and plans focused on offshore wind energy
- They are, in three out of four cases, located in countries with big domestic offshore wind markets, that serve as drivers for national and regional technology development
- They are home to leading RDCs within offshore energy and maritime operations, and
- They have a strong research and science base to support the endeavour of ECOWindS.

One of the key elements of the ECOWindS project is the feedback from triple helix stakeholders.



The triple helix consists of industry (both companies and trade bodies), science (education and research) and administration (local, regional and national government). (Etzkowitz and Klofsten 2005; Etzkowitz and Leydesdorff 2000) Potentially a cluster entails flowing types of organizations:

- Enterprises or “Industry”: private (or publicly owned) enterprises who engage in value creation through offering Offshore Wind Services
- Knowledge institutions or “Science”: universities, polytechnics, vocational training, research institutes
- Government and other administration or “Authorities”: Policy makers, national, regional and local government, policy agencies/implementers
- Additionally there are support organizations/institutions: Industry associations, technology centres, technology transfer offices, business incubators

Without the considered input from all three areas the project will not be able to deliver its full potential value as one of the key aims is to ensure that all the relevant stakeholders are aligned to the same action plan. What we want to avoid is industry, research and administration all working in silos and not pulling together as this would mean a slower overall development for the industry.

Definition of Offshore Wind Services

For the purposes of the ECOWindS Project offshore wind servicing is defined as the assembly through to maintenance stages of offshore wind farm activity. The OWS industry or sub-sector is summarised in the below diagrams. The project focuses on the services related to operation of an offshore windfarm, and thus will not be looking at areas like manufacturing components. However it is recognised the outcomes of the project may have a future implications for these other elements of the full offshore wind value chain.

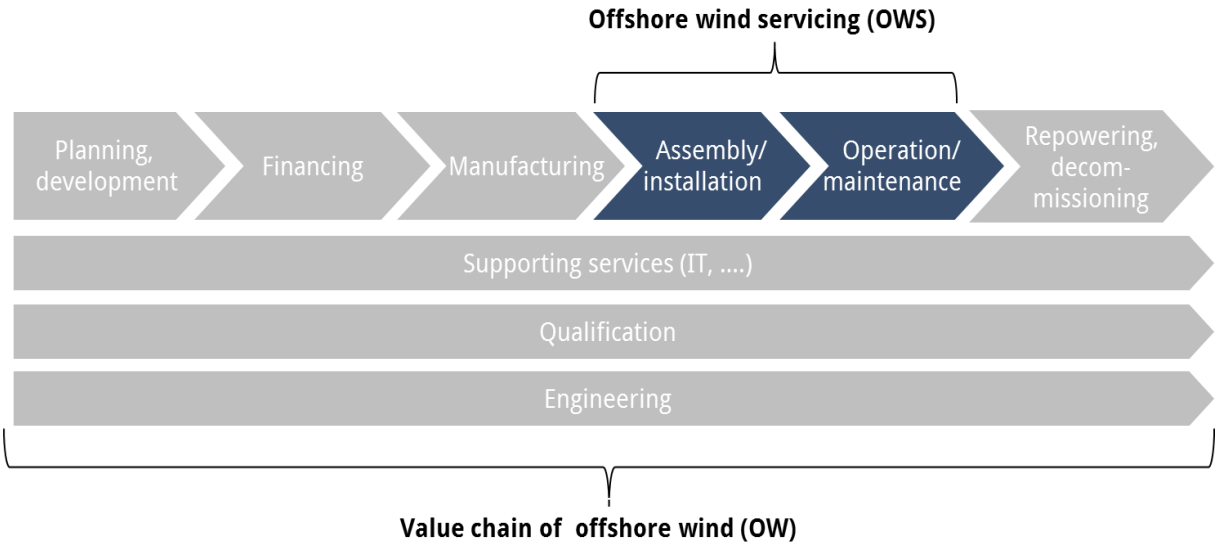


Figure 1: OWS within Offshore Wind value chain

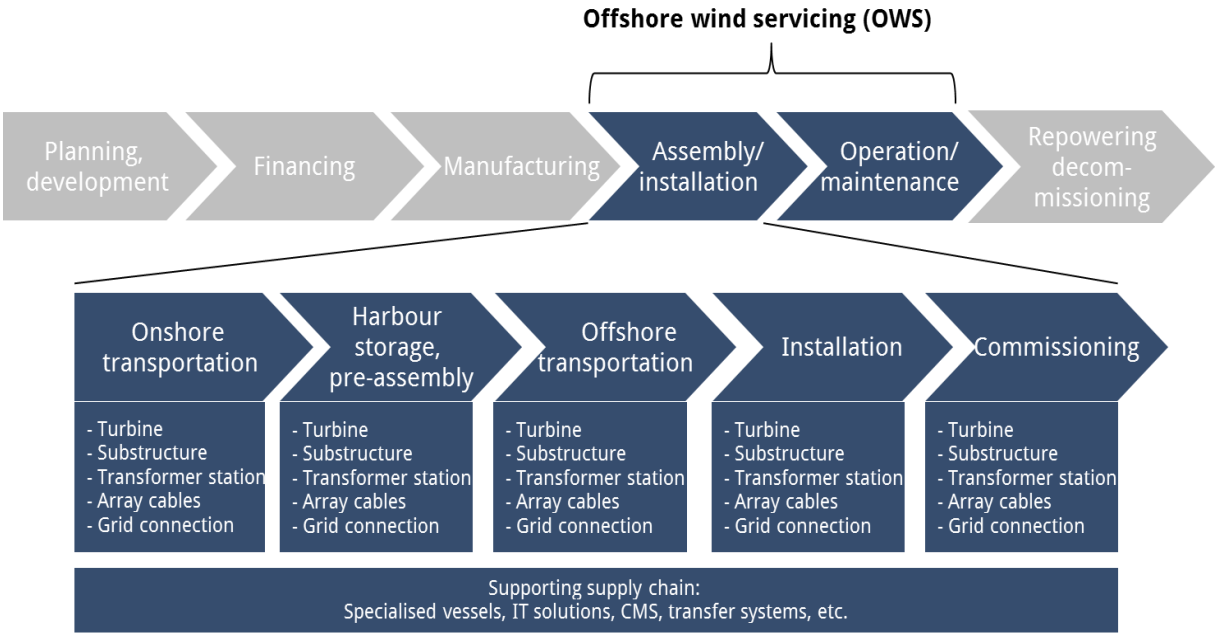


Figure 2: Detailed breakdown of Assembly and Installation

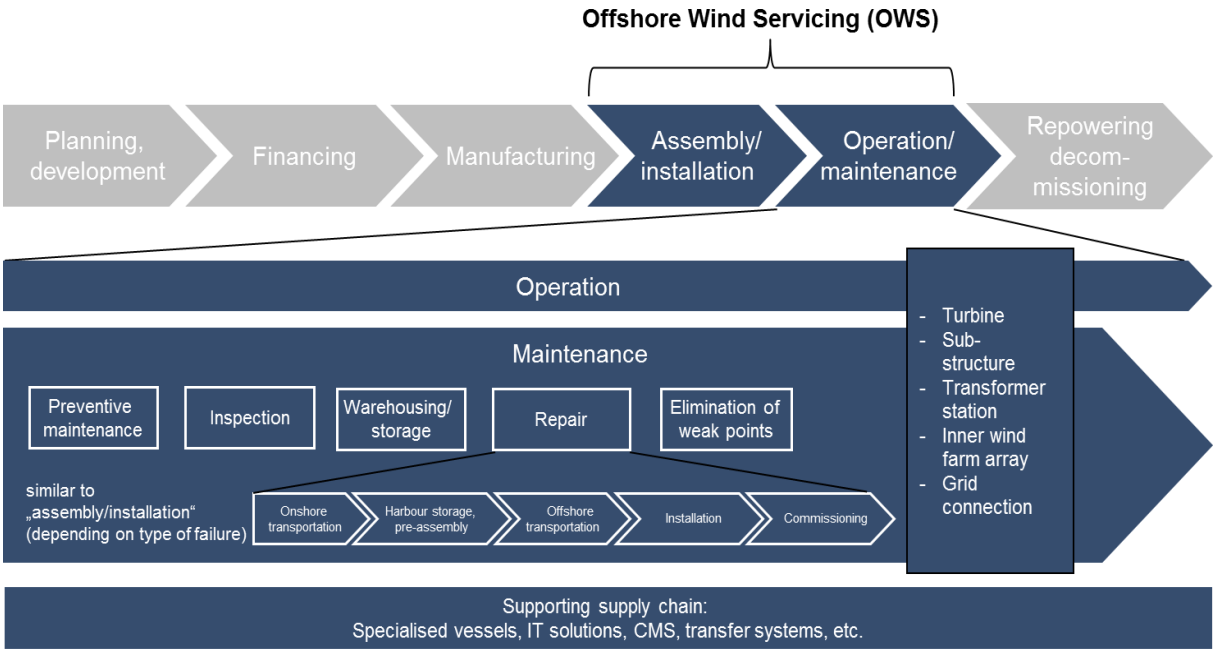


Figure 3: Detailed breakdown of Operations and Maintenance

The OWS industry is still in its infancy or the phase of emergence in most countries. The development of the industry is driven by the push for more renewable capacity in general, which then generates a pull for OWS. While the OWS as an industry is developing, its roots and analogies or substitutes can be found in the following relevant industry branches:

- Offshore industry; offshore marine service industry and offshore support vessels, including crane vessels, anchor handling towing and supply vessels, jack-up barges and platform/multi-purpose support vessels
- Electro-mechanical installations, operations & maintenance service industry
- Civil engineering, marine construction, cable laying

OWS lays in the intersection of wind energy, wind-relevant O&M, building and offshore service industries. The offshore industry refers in common use to offshore oil & gas industry, which is clearly adjacent and analogous, but may in the short term actually compete with offshore wind for OWS resources.

As such determining which enterprises belong to the OWS cluster is by definition dependent on the strength and nature of network activity between the enterprises, including product and service sales, communications and other collaborative activity such as joint RDI projects, joint ventures, collaboration agreements (e.g. Feser & Bergman, 2000; Porter, 2000).

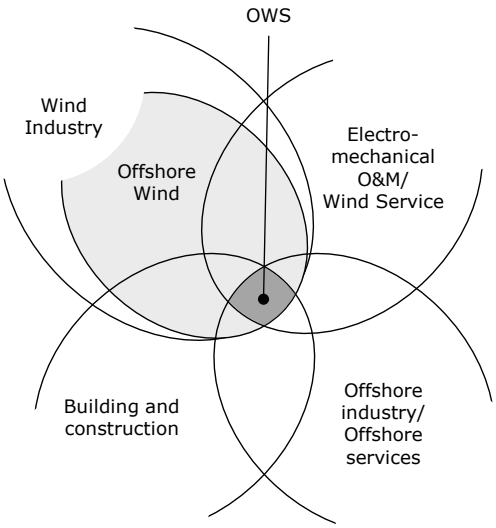


Figure 4: Position of OWS

Purpose and aim of the JAP

The objective of the JAP is to be an international, cross-regional, agenda for research, development and innovation *specifically* for Offshore Wind *Services*. The aim of the JAP WP is to establish a trans-national plan of action for supporting the development of Offshore Wind Service (OWS) industry through measures of Research, Development and Innovation (RDI). The JAP is an agenda for collaboration aimed to develop new and improved OWS business models, technologies and other concepts in support of general offshore wind cost reduction targets.

The JAP is a complement to other research agendas on wind power presented or under development by other organizations by approaching the challenges of offshore wind from the *service perspective*. To mention examples of other strategies and roadmaps complemented by the JAP, the European Wind Energy Technology Platform (TPWind 2014a) has presented a Strategic Research Agenda / Market Deployment Strategy (TPWind 2014b) in March 2014 , the European Energy Research Alliance (EERA) Joint Programme on Wind Energy (EERA 2014) has been running since 2010, the current JP Wind Strategy covers the period 2014-2030, and the meso level Strategic Action Plan 2014-2017. These collaborations and the strategies focus on a broad front of technology related to the wind turbines, electric infrastructure, grid integration etc., while the ECOWindS JAP explicitly and specifically focuses on the services for offshore wind farm installation, operation and maintenance.

The ECOWindS project started out with an analysis of the regional strengths, weaknesses, opportunities and threats (WP2) which culminated in selection of a strategic orientation (SOR) and development of a Smart Specialization toolkit and Internationalisation strategies for the partner regions (WP3). These earlier deliverables set a framework for the JAP that is a time-bound plan that operationalizes the SOR by defining what actions are needed to proceed towards the SOR within the framework of the ECOWindS strategy (see Figure 1 for illustration).

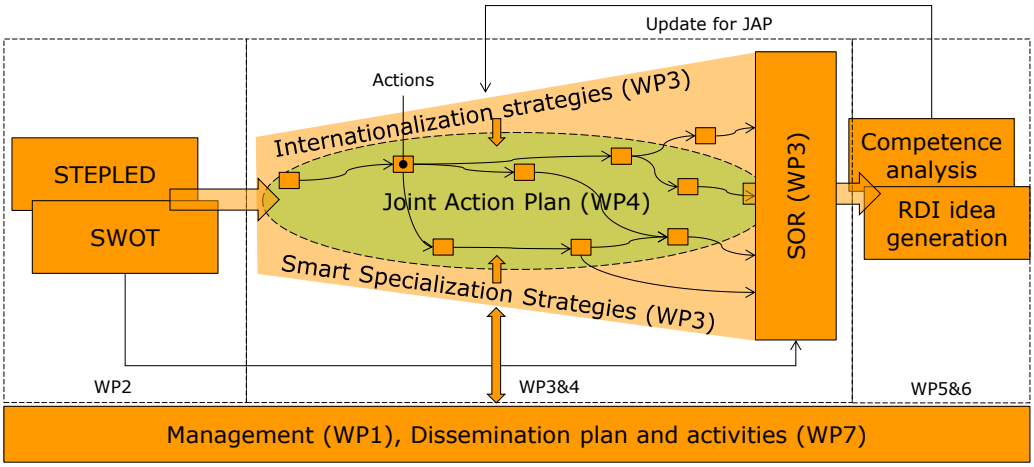


Figure 5: The JAP within the ECOWindS (the figure presents logical flow, not chronologically correct)

In more detail the JAP is informed by WP3 on one hand by the top-down view set by the SOR set based on the strategic position and opportunities of the OWS industry as described in ECOWindS Deliverable 3.1 (D3.1) "SOR report on strategic objectives" (available on ECOWindS website www.ecowinds.eu together with all other ECOWindS public deliverables) and on the other by the bottom-up view offered by the analysis of the delivery measures and strategies defined in in the "Smart Specialisation Strategy Report" (D3.2)

During the ECOWindS project, the project coordinator has been responsible for orchestrating the overall actions around the JAP. Discussions to form a long term 'Post-ECOWindS collaboration' to oversee the implementation of the JAP after the ECOWindS project have been started during the JAP process. It is foreseen that this post-ECOWindS collaboration will take the responsibility of coordinating the actions around the JAP and other ECOWindS deliverables. The organizational form of this consortium is not set and it does not have to be limited to present ECOWindS consortium. The main task of the coordinator of the JAP is to monitor the OWS industry and launch an update of the JAP with the post-ECOWindS collaborators to keep the JAP up-to-date and relevant for the industry constituents, and to support international collaboration on OWS specific relevant RDI as directed by the JAP.

JAP process

Following the logical flow of the project, the JAP is built on the analysis and strategy development from the first three work packages. Building on this framework, the core of the JAP content was formed in a participatory JAP workshop March 10th 2014. The workshop was held at EWEA Annual Event 2014 together with ECOWindS Midway conference. A broad group of stakeholders from the triple helix, altogether 31 participants, from the four regions were present at the workshop, comprising representatives from organisations for R&D and education, policy makers and offshore wind industry.

The key objectives for the midway conference and workshop were to present the results from ECOWindS Regional Mapping and Strategy Work Packages and to develop actions for the future of the Offshore Wind Service (OWS) industry in a collaborative road mapping process. DTU designed a collaborative roadmapping process and facilitated the group through the agenda. The workshop started with presentation about the key findings of the Regional

Mapping and proceeded to the Strategic Orientation and the ECOWindS Strategy Toolkit to set the framework for the actions for the future.

Building on the orientation presentation, the group was led to a collaborative roadmapping process. During the roadmapping phase, the group discussed key goals for the next 3-8 years in the OWS industry, prioritised them, and continued on to generate ideas for concrete actions to advance towards the goals. Then these ideas for actions were clustered and prioritised. The final stage in the workshop was a session for drafting roadmaps for OWS. The details of the workshop have been reported in (Piirainen 2014).

The main result from the JAP workshop were altogether 97 initial ideas for actions to develop OWS through Research & Development & Innovation (RDI) (see ECOWindS Joint Action plan, D4.1 for details). The ideas were clustered to 17 main actions, prioritized by the participants and organized to a timeline as an initial roadmap for the OWS industry. The following figure summarizes the results from the workshop as a roadmap, indicating a rudimentary time scale and expected level of the actions.

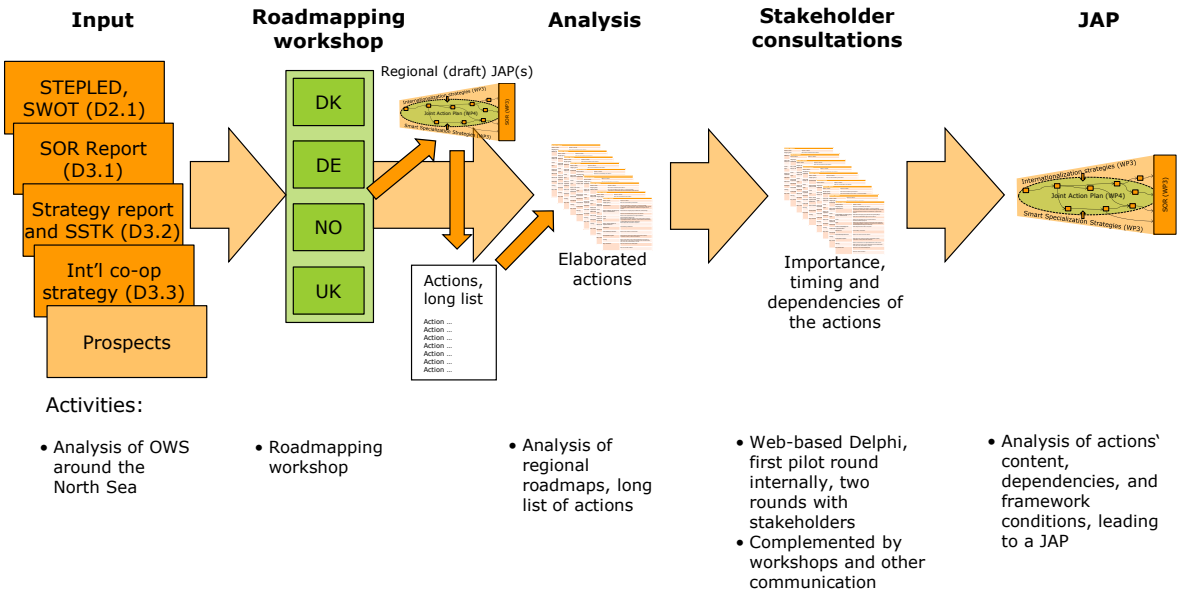


Figure 6: Overview to the JAP process

The workshop contributed the key ideas that will underline the final JAP. The process after the workshop has concentrated on following up on and refining the stakeholders' ideas and synchronising them with other ECOWindS findings. Following the March workshop, the ECOWindS partners have worked on the actions side-by-side with the delivery of the Strategic Orientation (WP3) and later Supply and Demand of Research Development and Innovation (WP6).

The actions were discussed and developed in a working meeting with the partners in September 2014, in Copenhagen. The meeting brought the partners' joint expertise together and synchronised between the parallel work packages. These elaborated actions (see D4.1 and below) are being made ready for stakeholder consultation, which paves the way for the updated final Joint Action Plan (D4.4) that will be released during 2015.

2. Strategic orientation of the OWS industry

This section presents a framework for the Joint Action Plan (JAP) by summarizing the key results of Work Packages 2 and 3 as they relate to the JAP. The relative strengths, weaknesses and opportunities of the ECOWindS regions provide a view to the present state of the art in OWS in the ECOWindS regions. The Strategic Orientation in turn provides a focus for the JAP by setting goals and a vision to be fulfilled through the actions.

Regional profiles

The overarching finding from the regional mapping analysis conducted in WP2 is that the ECOWindS regions have clearly complementary profiles (see the ECOWindS WP2 D2.1 “STEPLED and SWOT analysis of all ECOWindS offshore wind clusters”).

The German and Danish clusters are very strong in terms OEMs and manufacturing capabilities. Danish cluster is specifically strong in wind turbines, while German cluster has unique complementary capabilities in other components and unique position in far-shore farms. The German cluster is well integrated and has strong ties between the actors, as well as strong RDI activities, which build a good base for moving forward. The Danish cluster can be regarded as world leader in turbine technology by installed capacity and units sold. Additionally the Danish value chain is experienced in other components as well as delivering offshore wind farms due to a long history.

Norway in turn is very strong in complementary capabilities from maritime and offshore industry, particularly in shipbuilding and associated activities. Norway is known for delivering solutions for maritime civil engineering and offshore industry, and that history can be leveraged in OWS as well in conjunction with OWS contractors. The unique profile of the UK then is shaped by the fact that UK has by far the largest installed offshore wind capacity, and their expertise is specifically related to OWS from installation to O&M.

A complimentary analysis of regional profiles based on patenting activity corroborates the regional profiles (see Piirainen et al. 2014). The technology development in the regions supports the notion that Danish knowledge base on wind turbine technology is very strong as Norwegian is on vessels, while the German and especially UK clusters have a more even spread of focus among complementary technologies.

The common threat for all the regions has been somewhat unstable commitment to offshore wind within the framework of the European and national energy policies. The perception of shifting commitment and targets has caused a stalling in the existing project pipeline and in commitment to new projects. However, as the observation is that when new project pipeline was at the fullest, the resources were saturated and there was little time to focus on R&D. The slowdown of new projects should be taken as an opportunity to work on new value before the project pipeline fills up and the value chain has to focus on delivery. It is also clear that the regions outside UK struggle with a lack of a home market for OWS at the moment. This can be also taken as an opportunity to develop an international, ‘born global’, outlook and take the existing equipment and techniques honed by the initial experience overseas.

Strategic Orientation

The analysis of the four clusters led up to choosing a Strategic Orientation (SOR) for OWS across the regions, including a set of strategic objectives. The process for the creation of the objectives is detailed in ECOWindS D2.1 “Regional mapping analysis” and D3.1 “SOR report on strategic objectives”. The following list of Strategic Objectives is an aggregation of multiple similar and overlapping objectives:

- Knowledge sharing and exchange of best practice
- Standardisation and industrialisation
- Qualifications and skilled workforce
- Innovation and R&D
- Funding
- Business collaboration
- Political support and Industry regulation
- Strengthening the market position
- Infrastructure
- Data management

This list was used as a starting point for a round table discussion in the JAP workshop. The workshop participants were asked to propose the most important goal and evaluate how much new value reaching it would create and how urgent reaching it is. The following figure gives the result. The most important by the number of mentions in discussion are ‘Business collaboration’ with 35 mentions, ‘Standardisation and industrialisation’ (11), ‘Innovation and R&D’ (8) with the additional that RDI should be driven by OWS specific problems/goals, ‘Knowledge sharing and exchange of best practice’ (5), and ‘Infrastructure’ (5).

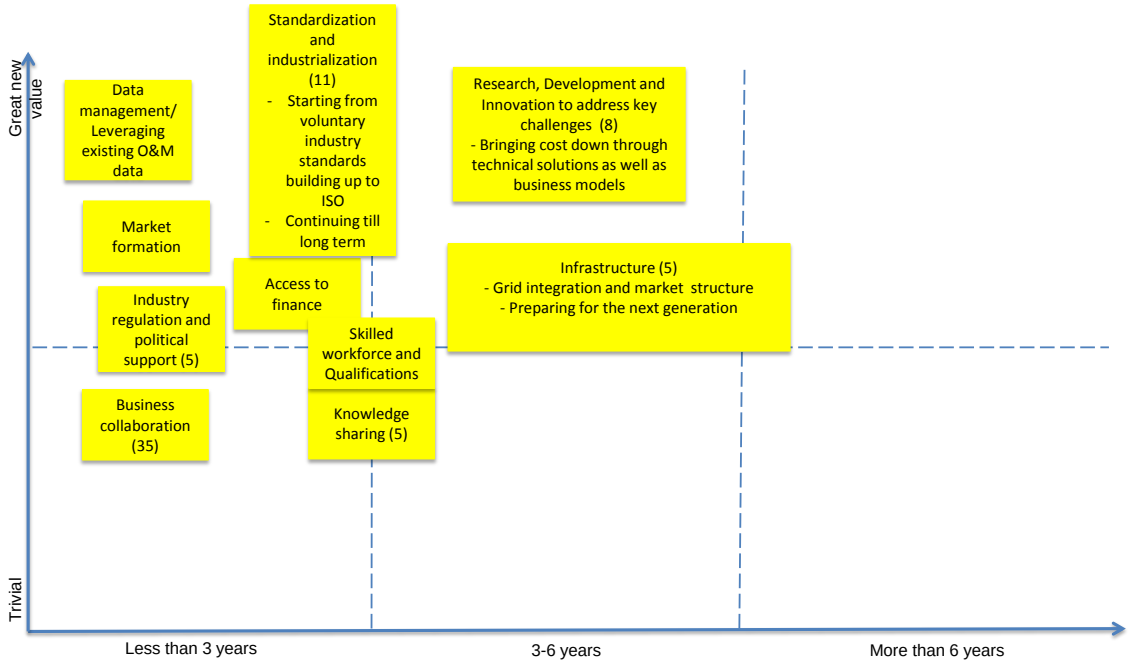


Figure 7: Priorities of SOR goals as discussed in the JAP workshop (Position indicates when the goals are important (horisontal) and what is their importance to OWS future (vertical), number of mentions/votes in parenthesis)

Following the prioritisation, the discussion turned into classifying the strategic objectives, and it was concluded that in fact an overarching goal that should steer RDI in OWS industry is to contribute to lowering the cost of energy as measured in levelized cost of energy (LCoE) for offshore wind. The OWS specific goals would be, mirroring offshore wind in general, standardisation to support industrialisation of the services. And in this emergent phase of the industry a key intermediary goal is to set up business collaboration and knowledge sharing within OWS and adjacent industries.

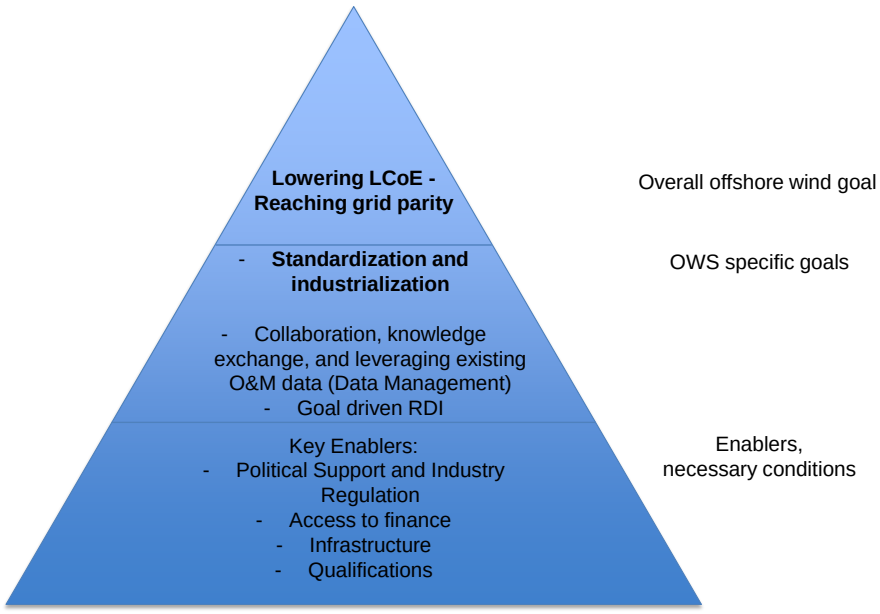


Figure 8: Goals for the OWS industry as agreed in the JAP workshop

Achieving these goals hinges in part on certain enablers. Thus it was agreed that attaining the objectives of industry relevant and favourable regulation, access to finance, RDI infrastructure, and qualifications as in qualified human resources, lay a solid platform for reaching the high level goals.

Taken altogether, the vision associated with the JAP is:

By the end of the JAP period (2020) OWS is a recognised industry with strong networks around the Globe and especially the North Sea. By that time the installed offshore wind capacity has multiplied, and as a consequence of the industrialisation and purposeful RDI and standardization efforts the key components have been standardised to an extent that enables smooth installation, interoperability between components, and efficient O&M services.

At the heart of this fruitful progress are strong networks and confidential relationships along the value chain that enable optimizing the delivery of value through the whole life cycle of the wind farm from the factory door to end of life. These networks involve the key stakeholders from operators and developers to turbine and grid component manufacturers, load handling and hauling enterprises who handle the components, to the offshore service enterprises who install and maintain the farms when installed. Within the network everyone knows their added

value and receives relevant information that enables them to continue to deliver value to the farm.

On top of this strong network lies a program of innovation and continuous improvement that drives all the stakeholders towards interoperability and standardisation on one hand, and bold innovation and experimentation on the other. This purposeful innovation program streamlines installation and O&M of the new farms to an extent that enables delivering cheap clean power reliably. Finally, as always, the success of OWS relies on a skilled and motivated workforce who can deliver value in every aspect of the value chain from research, development, engineering through transport to installation and O&M.

3. Joint Action Plan

This section includes the core of the Joint Action Plan. The JAP is first positioned to the existing complementary strategies and plans. The second sub section presents an overview to the actions, followed by the main narrative of the JAP. The actions themselves are attached as an appendix to the report.

Position of the JAP

As specified above, the JAP is an international plan of action for RDI that has specific relevance to the OWS industry. The objective of the JAP is to be an international, cross-regional, agenda for RDI. The JAP is an agenda for collaboration aimed to develop new and improved OWS business models, technologies and other concepts in support of general offshore wind cost reduction targets.

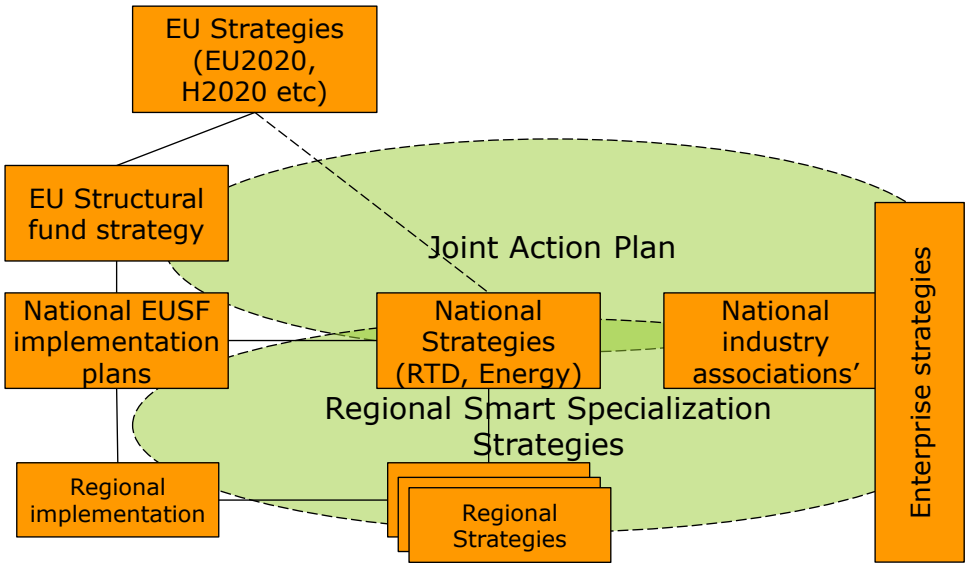


Figure 9: Position of the JAP between stakeholder strategies

The logical flow of the ECOWindS project is cumulative, and the JAP connects to both the SOR (D3.1, see above) and the delivery measures outlined in the Smart Specialisation Strategy Report (D3.2). The position of the JAP is to outline a portfolio of actions that comprises programmes and projects that will contribute to achieving the objectives. The delivery measures may be implemented concurrently within and beside the actions.

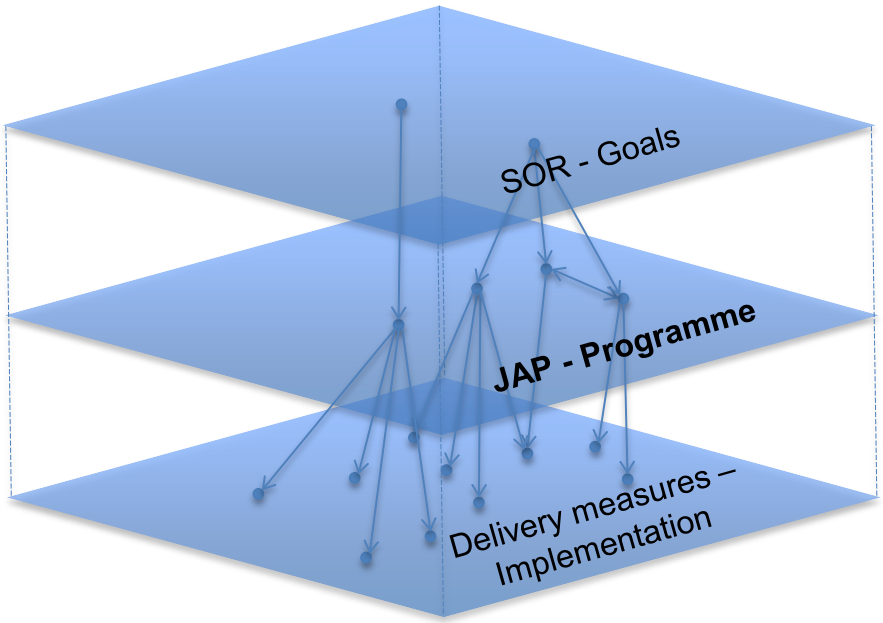


Figure 10: Relationship between ECOWindS SOR (WP3), JAP (WP4) and Smart Specialisation Strategy Delivery Measures (WP3)

The JAP is a complement to other research agendas on wind power presented or under development by other organizations by approaching the challenges of offshore wind from the service perspective. The examples of past on ongoing activities for strategising and standardisation in wind power include:

- TPWind Strategic Research Agenda / Market Deployment Strategy (TPWind 2014b)
- EERA Joint Programme on Wind Energy (JP Wind) (EERA 2014)Strategy covering the period 2014-2030 and the meso level Strategic Action Plan 2014-2017.
- Megavind Offshore Roadmap 2013-2020 (Megavind 2013)
- International Electrotechnical Commission (IEC) Technical Committee 88 'Wind Turbines' standardisation program (IEC 2014)

In short, these strategies focus on the hardware that counts for a wind farms capital expense (CAPEX). These collaborations and the strategies focus on a broad range of technologies related to, for example, the wind turbines, electric infrastructure, grid integration and foundations/sub structures. In these strategies, the proposals that are most related to OWS include developing technologies to plan and optimise O&M by e.g. condition monitoring, fault detection and prediction, application of Design for X –principles (Design for eXellence, in other words, Design for Assembly, Design for Installation, Reliability, etc.) to wind turbine components.

ECOWindS JAP explicitly and specifically focuses on activities that complement the existing programs and enable development of OWS, that is, the services for offshore wind farm installation, operation and maintenance that count towards the operating expense (OPEX). The relationship of ECOWindS and technology is that the project influences the direction of technology development by documenting RDI needs particularly in WP6 and facilitates building RDI collaborations. Even the technologies proposed in ECOWindS will likely be on the borderline of OPEX or RDI expense for the farm operators, rather than CAPEX.

Overview to the actions

The action plan consists of 8 proposed actions, which can be divided into four parallel work streams which support each other. The following table presents an overview to the actions in terms of purpose and rationale (Table 1). The action themselves can be viewed as projects or programmes that make up a portfolio for OWS development. In the following overview, the actions are presented quite briefly. The full details as proposed by the ECOWindS consortium can be found in Annex A.

Table 1: Overview of the actions (see Annex A for details)

No.	Action	Purpose	Rationale
1	Establish a long lasting joint initiative for knowledge sharing and innovation between regions	The purpose of this activity is to support OWS specific collaboration and to complement the existing collaboration efforts by focusing on international and cross regional collaboration by bridging existing regional platforms to enable new business collaboration across regional and cluster borders.	The OWS industry is early in development and still fragmented. Grasping the collaboration opportunities and leveraging the complementary assets between industry constituents as well as relevant research are needed to realize the growth potential for and value of OWS. Thus existing efforts need complementing with added focus on OWS specific topics and international collaboration.
2	Develop a value proposition for OWS as an industry in itself	Stakeholders need to understand the value created specifically by OWS within the framework of offshore wind. Today the OWS value chain is fragmented as the actors identify with different industries. Recognising OWS as an industry enables capturing synergies and consolidation over old industry boundaries.	Improve communication within and outside OW/-S industry by developing a clear brand message for OWS tailored for various stakeholders for OWS and establishing a communication platform for delivering the message.
3	Develop OWS specific mission-oriented research, development and innovation program	There is a need for R&D to lower the cost of offshore wind energy. Common agreement over the specific industry goals and finding mutual interests and collaboration opportunities leading up to cost reduction in OWS Increased knowledge, new technology and new business opportunities are needed	Develop a problem driven and *OWS specific* international research program with clear priorities and a focus on generic large scale technologies which are important for OWS and are not featured on existing research agendas, e.g. TPWind, where collaboration has significant benefit.

No.	Action	Purpose	Rationale
4	Drive for international OWS specific standards	Standards enable incremental cost reductions in OWS value chain and offer the possibility to drive for economies of scale in manufacturing and O&M through industry standards. The long-term result is less complexity in wind farm planning, installation and maintenance, incremental cost reductions.	Provide a platform for technical standardization and drive emerging industry standards towards official status in key areas, building on the short term actions and building relations towards the future.
5	Develop OWS specific skills and training programs across regions	OWS specific training programs and qualifications contribute to availability of skilled and qualified workers for the demanding OWS tasks and improves labour mobility. Better labour mobility enables flexible OWS, lessens local labour shortages and leads to incremental gains in O&M cost.	Harmonize skills and Occupational Health and Safety requirements and certifications for OWS across EU. Develop EU-wide economically and socially sustainable common qualifications and certifications for OWS workers to complement the existing GWO standards. Develop matching international training programs.
6	Develop an OWS Industry Database	Development of new business across the regions and optimization of existing services through collaboration need comprehensive solutions for information exchange. The industry database/portal aggregates knowledge relevant specifically for OWS to facilitate collaboration and knowledge sharing in operations and RDI for OWS	Support development of OWS services and the emergence of international networks by aggregating relevant knowledge to understand what are the challenges and problems to solve.
7	Establish OWS Specific Test Sites and Research Infrastructure	Increased experience and knowledge about reliability and maintenance need of new technologies; development and testing of new installation and O&M procedures and technologies; develop and test wind farm concepts – leading up to lower life-cycle cost in large scale installations Innovation leading to lower lice-cycle cost/LCoE	Build international offshore test sites for new offshore specific technologies, using existing infrastructures onshore and offshore where appropriate.
8	Drive regulatory harmonization on Occupational Health & Safety	Harmonization of regulation on OH&S improves mobility of skilled workers and allows flexibility for OWS without endangering personnel or equipment. Better labour mobility enables flexible OWS, lessens local labour shortages and leads to incremental gains in O&M cost	Develop EU-wide common qualifications and certifications for OWS workers across jurisdictions

Flow of actions and timeline

The central storyline of the JAP is that through development of inter-regional interconnections, the OWS enterprises gain complementary capabilities (see D2.1 and D3.1, as well as Piirainen, Tanner, Alkærsig, & Andersen 2014) and are able to deliver new and improved services for the operators. At the same time the networking that creates closer business relations enables quicker and more candid feedback within the whole offshore wind ecosystem that enables standardization of components, processes and practices, which lays foundations for the continuous improvement of the OWS service delivery.

Following this logical framework, the first work stream of proposed actions include three 'coordination' actions that build the necessary networks and social capital that is needed to achieve the major actions. Within the stream, the first action is setting up a knowledge sharing initiative between the clusters (Appendix A, Action 1, henceforth A1). It is a recognised challenge for the OWS and offshore wind industry in general, that lack of communication and coordination within the offshore wind value chain creates resource congestion and cause bottle necks for delivery of solutions and services (Stolpe et al. 2014). The initiative is driven by the industry associations, first by the ECOWindS partners and later a Post-ECOWindS consortium comprising major European Offshore Wind and OWS industry associations and cluster management organisations. Setting up concrete networking activities locally and building international linkages enables networking within the industry, which contributes to building future RDI and business ventures.

The second proposed action (A2) to be undertaken concurrently is outlining a clear value proposition and message for the OWS industry as an industry in itself. OWS as an emerging industry is to a degree overshadowed by or lost within offshore wind. While capital expenditure (CAPEX) and other up-front development considerations play a major role in determining the Levelized Cost of Energy (LCoE), OWS contributes up to 46% of LCoE (CAPEX and operating expenditure, OPEX) including project development and other services, installation, and operations and maintenance (O&M) over the life-cycle of a wind farm. O&M alone (OPEX) is estimated between 25 and 28% (Stolpe et al. 2014; Green and Vasilakos 2011; Azau and Casey 2011). Thus the goal of the action is to raise the industry profile by creating a clear value proposition and communicate it.

The third action (A3) is setting up a mission-oriented and OWS-specific RDI program. The added value of the program is to complement the existing programs and roadmaps reviewed above by consolidating OWS specific topics to one program. The aspiration of the OWS RDI program is to achieve a similar standing with EERA, TPWind or Megavind research agendas. The action proposes several alternative topics based on stakeholders' expressed interest; the key in this action is to leverage the knowledge sharing platform to build serious consortia around the topics and continue to building projects and proposals around the stakeholders' interests. The action is driven by a post-ECOWindS consortium, together with key stakeholders who have the interest to drive the individual projects forward.

Additional fourth coordination action is building an OWS database and portal (A6) supports communication and RDI. The aim of the database is to provide a one stop shop for information that enables benchmarking reliability and service efficiency and optimizing services across farms relevant specifically for OWS stakeholders. This action supports specifically knowledge exchange (A1) and on the other hand the knowledge exchange feeds

back to the database. Further the database is an indirect support for the rest of the work streams, particularly communication and RDI.

Building on the foundation of coordination the second work stream is ‘Research, Development and Innovation (RDI)’. The core of this stream is a research program of OWS specific research topics that complement the existing RDI that goes on in wind power and offshore wind. The key underlying theme in OWS specific RDI is development of interfaces between the components of a wind farm and the service equipment. The aim is to achieve a degree of standardisation that enables effective installation and O&M of offshore farms, while not being stifling to innovation in key technical areas that add value to power generation.

The work in this stream build directly on the RDI program set with the stakeholders as the action (A3) unfolds. However, based on stakeholder consultation, certain key themes for RDI arise. From a technical OWS perspective, the installation cost of a wind farm depends within the given environmental conditions on the ease of installation of the components and their compatibility with each other and the installation equipment, while the effectiveness of the O&M services depend on interoperability and compatibility between service equipment and vessels with wind farm components. Another aspect is development of robust procedures for installation, operation and maintenance, to increase availability of service, effectiveness and independence from the weather conditions. The core of the RDI program will be developed in ECOWindS WP6. The program is highly synergistic with the harmonisation actions (below) as joining forces in RDI open the door to develop effective industry standards that pave the way for official standardization.

A related core action in the mid-term is establishing OWS specific test sites and other research infrastructures (A7). Present test sites are very focused on improving reliability and performance of turbines alone or as farms. However, the exiting sites do not enable testing core OWS technologies and procedures that are related to installation and O&M procedures, and secondarily on foundations, grids, transformers and turbines insofar that these major components impose demands on the OWS procedures.

The third work stream is ‘harmonization and standardization’. The core action is drive for OWS specific technical standards (A4) together with key OEMs. There are serious on-going efforts for standardization, not least the IEC TC88 on wind turbines and components. The objective of this action is not to supersede or replace existing efforts but to complement, provide added drive and introduce OWS specific topics and viewpoints to existing standards committees and processes, and secondarily set up new standards initiatives within existing frameworks as needed.

The harmonisation work stream intersects with skills (see below) in the proposed long-term action to contribute to harmonisation of formal and informal qualifications and training certificates needed to work on OWS across the ECOWindS regions and beyond (A8). The aim is to propose harmonisation between national occupational health and safety (OH&S) guidelines, to find an acceptable level of protection and harmonised certificates for OWS. The work is parallel to Global Wind Organization (GWO) OH&S work and compliments it for offshore specifically. An additional topic is training certificates, technical and OH&S related, required to work on OWS. There is a need to harmonise health, safety, environmental and quality (HSEQ) policies in conjunction with the developing guidelines.

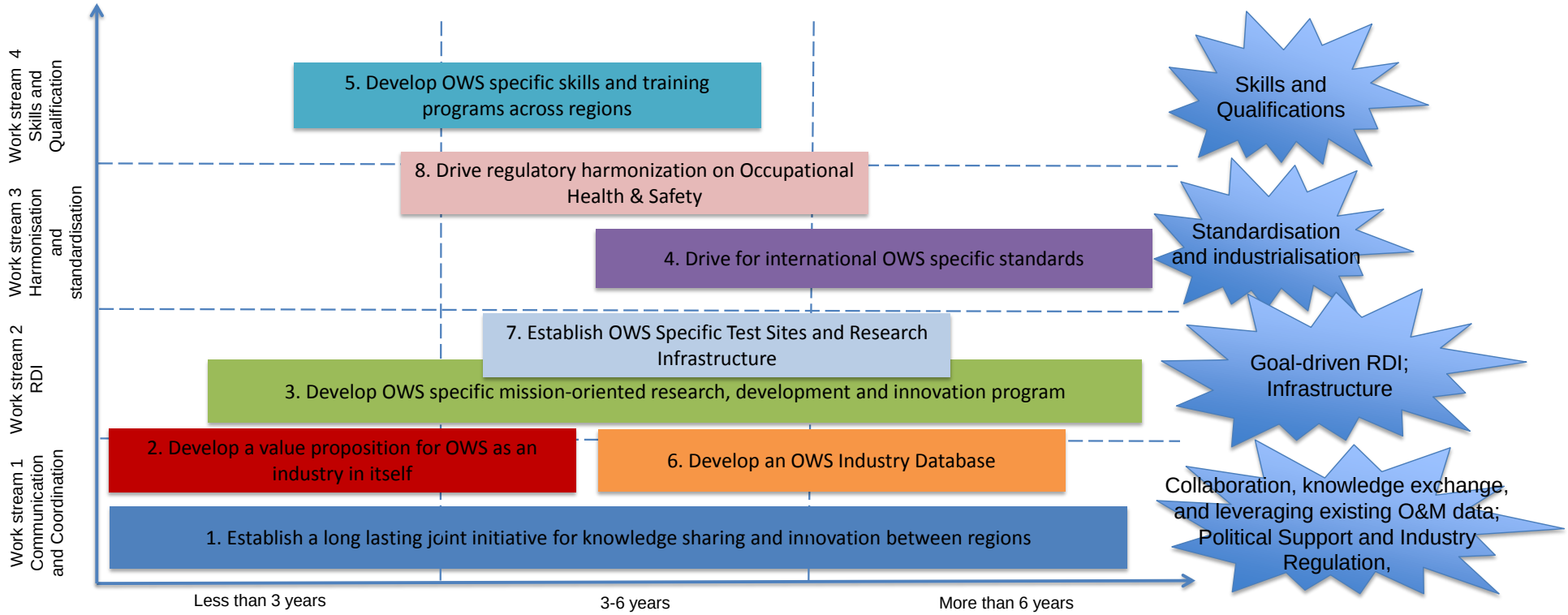


Figure 11: The Joint Action Plan timeline with work streams

The fourth work stream is ‘skills and qualifications’ that relates strongly to harmonisation action on skills and training (A8). The aim of the final work stream is to ensure that there is a skilled and qualified workforce to ensure efficient operation of offshore farms and by extension reliable delivery of power. Offshore wind capacity is projected to grow tremendously in the coming years (IRENA Secretariat 2012; Corbetta 2014), which means that OWS capacity has to grow proportionally to cover not only installations but the whole spectrum of life cycle services. However, the existing OWS resources are already employed close to capacity.

The main action proposal is to develop OWS specific training programs that ensure enough skilled labour is available for OWS in the future (A5). The aim of the action on one hand is to identify the core skill sets and formal qualifications needed to work effectively and safely in various OWS tasks, and design a portfolio of corresponding training packages to deliver the necessary skills and qualifications both within the context of secondary education and as life-long learning programs. On the other the aim is to establish a ‘skills gap’ for the need of training and education in quantitative terms to enable OWS industry and educators to see what concrete action is needed to ensure that there is a workforce to keep the increasingly important offshore wind farms up and running for the years to come.

To summarise, Figure 12 (above) illustrates the sequence of the proposed actions and their relations to the goals of the industry. Each work stream contributes to one or more sub goals set for the JAP, which together take OWS and offshore wind closer to the overall target of lowering LCoE 40% by 2020. The dependencies of the action discussed above are not shown in the figure for the purposes of clarity. The coordination work stream creates a basis for arguing the importance getting the support for OWS. It also serves to build the collaborative relations and consortia needed for effective goal-driven RDI that in itself contributes to the goal of establishing RDI to develop cost-reducing innovations. The third work stream builds on the previous ones and contributes both to technical standardisation and harmonisation of skills and qualifications. Last but not least, the fourth work stream directly contributes to skilled and qualified work force for OWS.

Concerning the implementation of the actions and the JAP as a whole, the ‘owner’ of the JAP is in a sense the OWS industry, who has an interest to drive the JAP forwards. However, during the runtime of the project, the ECOWindS consortium represents the industry in terms of managing the JAP process. It is proposed that a post-ECOWindS consortium that comprises industry associations, OWS enterprises and operators, who together have the most direct interest in the matter, is to be formed to continue driving the JAP actions and keeping the plan up to date.

The key to successful implementation of the JAP is to bridge existing national knowledge bases together and find complementary partnerships that are stronger together In terms of the individual actions, it is proposed that each action is implemented by a specialised consortium of stakeholders with the most interest to drive the action forward. There are two benefits. First, it ensures that the best capabilities and relevant interests are represented in implementation of each action. Second, the responsibility is distributed outside the (post-) ECOWindS consortium to enable more effective parallel implementation of the actions.

A key running theme in the JAP and actions is that they aim to bridge national interests together, to enable cross border collaboration starting particularly around the North Sea and

extending overseas as the industry goes. The actions are primarily to be implemented on the cross regional or international (European) level following the core logic of the JAP. Despite that, some of the actions have repercussion on regional and organisational level. To take an example, the RDI programme (A3) includes sub-actions that can be completed by one organisation if so desired. Also the skills action (A5) can be partially implemented by individual organisations who wish to offer training and education for OWS. However these two also include trans-national components that aim to bridge the strengths of various actors to create international impact.

4. Implementation Guidelines

This section outlines implementation guidelines for the JAP. The guidelines include particularly discussion on the priority of the actions, a financial plan for funding the actions and a plan for dissemination of the JAP.

Priority of the actions

As per the process described above, the priority of the actions is based on a stakeholder consultation and an interpretation by the ECOWindS consortium. The prioritisation has fed directly into the logical sequence of the actions presented above in the overview of the JAP (section 3 of the report), and determined the order of proposed implementation. However, there are two additional perspectives to consider regarding priority if these proposed and future actions.

The first perspective is the abstract priority of the actions by the stakeholders and the assessment of value versus fit to present capabilities, which in turn gives an indication of how much investment in learning and capacity building is required to implement the action successfully.

Another way to look at it is to analyse how the capability can be built through sequencing the actions so that the learning during implementation is cumulative and the actions support each other. The main message of the visual key is that low value activities should be invested in only if they are a source of strong cash flow that enables investment further. Regarding investment, the key is to develop a cumulative concession of investment that enable broadening capabilities outside the current comfort zone to new areas (see Figure 12 for illustration). The following analysis is conducted from this perspective.

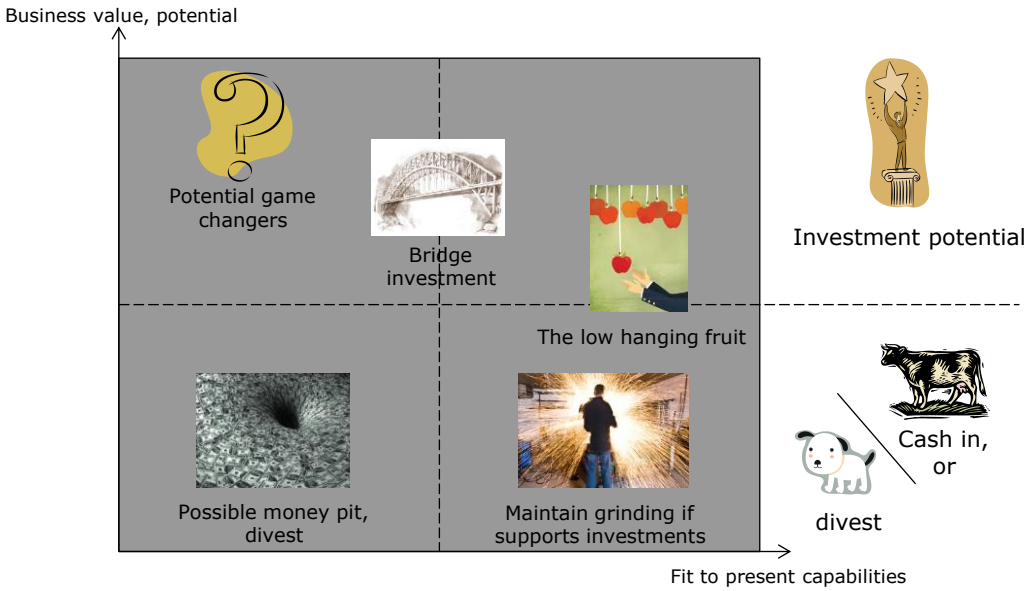


Figure 12: Priority of the actions in term of fit to existing capability and value (medium to long term perspective)

The following table presents the priorities of the action based on analysis by the ECOWindS partners and the stakeholders. The associated figure (13) illustrates the priorities. The horizontal (x-) axis represents the ease of implementation and thus fit to capabilities by proxy and the vertical (y-) axis represents the expected value for the industry. Additionally the bubble size represents the aggregate priority given for the actions in the JAP workshop.

Table 2: Priorities of the actions (The colour swatches in the second column refer to figure 14)

N.		Action	Fit	Value	Priority
1		Establish a long lasting joint initiative for knowledge sharing and innovation between regions	12	8	29
2		Develop a value proposition for OWS as an industry in itself	16	1	13
3		Develop OWS specific mission-oriented research, development and innovation program	7	5	35
4		Drive for international OWS specific standards	0	25	46
5		Develop OWS specific skills and training programs across regions	5	9	26
6		Develop an OWS Industry Database	2	1	28
7		Establish OWS Specific Test Sites and Research Infrastructure	1	4	1
8		Drive regulatory harmonization on Occupational Health & Safety	1	1	7

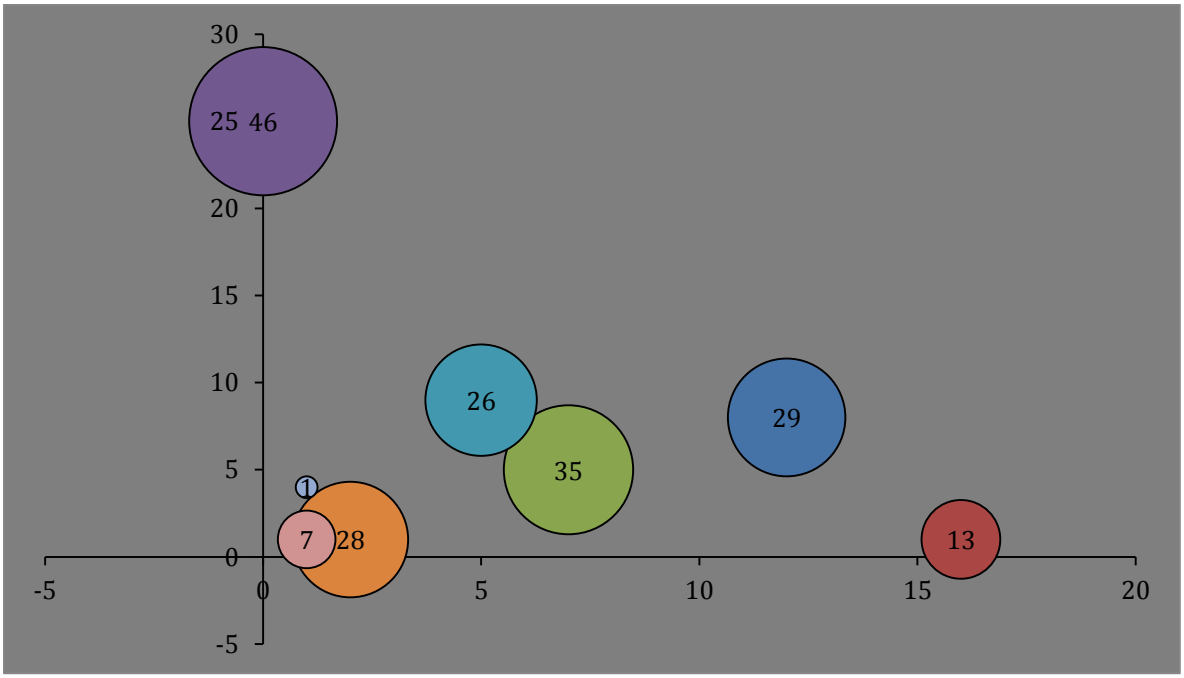


Figure 13: Priorities of actions in terms of fit/ease of implementation (x-axis) and expected value to industry (y-axis) the bubble size is the priority score given for the action by the stakeholders.

The story told by Figure 13 is that the proposed actions lay important foundations for the industry. The most expected value is expected from the development of OWS Specific standards (A4), skills and training (A5), knowledge sharing (A1), joint R&D programming (A3), and research infrastructures (A7). These estimates correspond quite well to the stakeholder priorities.

The interesting aspect is that many seemingly high value actions have relatively low fit to the present capabilities as estimated by the ECOWindS partners. Here the cross-reference to stakeholder priorities is instructive, as the analysis discussed above might suggest abandoning the actions because of poor fit to present capabilities. The alternative interpretation could be that the fit to capabilities represents primarily the industry association view to how well they see themselves able to take the actions forward, while the stakeholder priority suggest the importance or value to stakeholders in general. The clear standout is the OWS specific standardisation action, which at the same time stands out as absolutely the most valuable action while also hardest to implement. Thus the present implementation capability cannot be considered as an obstacle to implementation, but rather as a challenge that needs to be overcome to realise the goals for the JAP.

Taking the actions together then, a qualitative interpretation might be that the bulk of the actions lay a strong foundation for the industry to push towards the goals. Thus the recommended and logical implementation order is starting from the right side from action 2 and 1, building a critical mass of interested stakeholders to gather momentum around a commonly agreed RDI program (A3) built on the JAP and ECOWindS WP6 through to training programs (A5) and finally to standardisation. In quantitative terms the cluster of actions in the lower left of the figure seem relatively unimportant, but creating a database for OWS (A6), driving for OH&S standards (A8) and research infrastructures (A7) are important foundations for success of the other action in the long run.

Out of these actions ECOWindS WP5 contributes directly to the establishment of the training programmes (A5). The WP5 contributes directly to establishing training scenarios for OWS and thus contributes to establishing relevant training in the future. In the same manner, ECOWindS WP6 creates a foundation for the research program (A3) by collecting and evaluating relevant research ideas that act as kernels for research projects that aim to bring OWS closer to the goals. Further, ECOWindS also contributes partly to developing a clear image of OWS as an industry in itself.

In general the actions need a broad based consortium, involving industry, research, education, and public administration to implement them effectively. The actions do generally fall into the categories of RDI and business development. The role of the ECOWindS project and consortium was discussed above, and it is to lay a foundation on certain actions and to act as a facilitator to form appropriate consortia to implement the actions. Another general principle is to include partners across regions including but not limited to the ECOWindS regions. The rationale is to leverage the best capabilities to enable mutual learning across European regions. Further, international scope of the projects enables attracting a wider base of funding, as well as an impact.

The general condition for realising these actions is to build a strong consortium for each action, with the ability to implement it effectively and with the interest to drive it forwards. The latter essentially mean that from the start the consortium members for each action should be

aligned in their interest towards the action. In general the assumption is that the JAP is managed by a post-ECOWindS collaboration that will facilitate initiation of the actions and consortium building. The consortium structure and members depend on the action. However, a general recommendation is to involve stakeholders along the value chain from OWS contractors, and suppliers through OEMs to operators. A lesson learned in virtual centres of excellence elsewhere is, that they tend to function most efficiently, when they are organised along the value chain of a strong network engine (Lähteenmäki-Smith et al. 2013). Incidentally these actions also serve as a platform for further collaboration towards the goals of the JAP and industry.

Financial plan

Overview to funding opportunities

The core of the financial plan is to answer the question 'how to mobilise funds.' The generic funding opportunities for these actions are international, foremost European, RDI subsidies and grants, national subsidies and grants, and private funding/investment.

Starting from the international level, most of the actions are eligible for European funding from Horizon 2020 – The Framework Programme for Research and Innovation (H2020) if the consortium is appropriate. The purpose of H2020 is to create knowledge and facilitate networking between the European states. Depending on the specific action they might qualify either as a Collaborative Project or a Coordination and Support action. Particularly the Work Programme ' Secure, clean and efficient energy' is relevant to the actions, with a range of topics from project development assistance and market roll-out assistance of innovative energy services, and next generation technologies related to renewable energy, to modernising the European electricity grid. Besides the flagship H2020 program, there are a number of other EU programmes that support 'clean tech' and alternative energy innovation. H2020 houses Intelligent Energy Europe (IEE) that funds particularly small and medium sized enterprises (SMEs) to remove non-technological barriers around renewable energy technology adoption.

An important funding source could prove to be the European Union Structural and Cohesions Funds, which are administered nationally by National Managing Authorities. The eligibility of funding depends on the region. ERDF funding is further divided to Regional Development Fund (ERDF) and Social Fund (ESF). During the present programming period, focus on innovation and inter-regional collaboration has been reinforced, making ERDF a possibility. Especially concerning research infrastructures (A7), ERDF funding as opposed to most other RDI subsidies and grants specifically enables investment to tangibles that enable RDI. ESF funding in turn is geared for enabling life-long learning through capacity building activities.

The challenge with national funding is that it is most often tied to a national framework and organisations registered in the country. As such developing international projects would require matching parallel national projects or confining the implementation to one country or region at a time. The specific national funding sources are reviewed in depth in the Regional Mapping report (D2.1)

As for private funding, the main categories are capital investment by stakeholders, private or institutional investors, and debt funding. Additionally joint venturing can be considered a form

of investment in this context, if some of the actions would be for example implemented by a newly created enterprise. Additional private investment is likely needed as a collateral funding, as especially European funding as a rule is a subsidy, i.e. only a certain percentage of the cost is reimbursed and contributions in-kind or in some other fashion are required from the consortium. From institutional investors European Investment Bank (EIB) and in particular the European Energy Efficiency Fund (EEEF) invests in sustainable energy projects to support EU SET Plan. The aim of the EEEF is to support sustainable energy technology through investments.

The following table condenses the analysis of what subsidies might be available to fund the action, to be considered during the project inception. The main source to complement private investment would be H2020 in most cases, due to the breadth of scope and volume of funding. In fact during the present programming period which has just started, the EU RDI instruments have been strongly consolidated under the H2020 program to avoid fragmentation and multiple layers of administration. The skills and qualification however (A5 & A8) are most likely candidates for ESF funding that is geared to enable life-long learning and development of skills. Similarly the research infrastructures might be eligible for ERDF-funding which directly aims to enable investments to critical infrastructures that enable value creation. In addition to subsidies, the infrastructure project could be eligible for capital funding from EIB and EEEF in addition to national funding opportunities.

Table 3: Actions and possible funding sources

No.	Action name	Possible public funding sources
1	Establish a long lasting joint initiative for knowledge sharing and innovation between regions	H2020 IEE
2	Develop a value proposition for OWS as an industry in itself	H2020 IEE
3	Develop OWS specific mission-oriented research, development and innovation program	H2020 and national funding for projects inside the programme
4	Drive for international OWS specific standards	H2020
5	Develop OWS specific skills and training programs across regions	ESF
6	Develop an OWS Industry Database	H2020
7	Establish OWS Specific Test Sites and Research Infrastructure	ERDF EIB EEEF National funding
8	Drive regulatory harmonization on Occupational Health & Safety	ESF

Principles for mobilising the funding effectively

The key to matching the actions to funding is recognising what is the added value of the action (-s) to the funding agency. The first step to attracting funding are to refine the purpose and scope of the action as proposed in Annex A with a small core consortium, and determine the deliverables according to the then current need of the consortium. Based on that 1-page project outline, the full consortium of partners is formed.

When the preliminary project framework and consortium is finished, they are matched to available instruments and refined. In this stage both the project outline and the consortium needs to be refined to offer a good value proposition for the funder. The key questions include:

1. Are the purpose and scope of the project significant enough to merit funding?
2. How does this project match or advance the policy agenda of the funder?
3. Why is this consortium the best out of all the eligible partners to execute this project?
4. Do the partner competences and deliverables fulfil the purpose and scope?

When the project outline and consortium match the available funding, the preparation of the project plan and the actual application start. As for the technical preparation of the funding application for the actions, the European Commission and other funders publish guides for applying and templates that prescribe the technical details of application procedure and specific information required in the application. This information is liable to change, and is not discussed here in detail.

The planning of projects is another pertinent topic. Most organisations have an established style and practice of planning and managing projects, and thus that is also a topic that is not dealt in detail in this report. For additional guidance, the readers are encouraged to consult for example the Project Management Institute Body of Knowledge (*A Guide to the Project Management Body of Knowledge (PMBOK Guide)* 2013).

The ECOWindS partners' role as the owners or coordinators of the JAP is to facilitate uptake of the actions among the stakeholders and help build consortia to execute actions. Here the ECOWindS partners can play a key role in identifying and matching partners from their regions to European projects.

Dissemination plan

This section presents a plan for disseminating or valorising the JAP specifically. It is coordinated with the principles of the ECOWindS dissemination activities and dissemination plan (WP7, D7.1 "Communication and dissemination plan").

General principles

The overall goal of dissemination for the JAP is to support the impact of the JAP and ECOWindS in general. The sub goals are to:

1. Raise awareness of the JAP in OWS stakeholder groups (c.f. target groups below)
2. Support implementation of the actions

The responsibility for the communication during the ECOWindS is with the ECOWindS consortium as planned in the project dissemination plan. The final responsibility for dissemination is with the project coordinator. However, as the JAP is a document that is meant to continue as a platform for collaboration for the OWS industry, communication is passed to a post-ECOWindS collaboration as described in ECOWindS D4.3 “Evaluation and Adaptation Report”.

The ECOWindS partners and later the post-ECOWindS collaborators share a responsibility for dissemination of the JAP to their own stakeholders through their networks especially in their own regions. However international appearances should be coordinated to avoid unnecessary competition on presentation slots and enable stronger unified message delivery.

The principles for communicating the JAP include tailoring the delivery of the message to the audience and situation. The JAP is delivered in this report as a one-size-fits-all solution. However, to support the implementation of the JAP, the message needs to be tailored for the audience in terms of their interests, knowledge and as far as possible personal style of decision making. The key to effective presentation is adapting the substantive content to the knowledge level of the audience as well as the emotive content to suit the situation and ‘room temperature’. Another aspect of tailoring the presentation to an audience is choosing who delivers the message to which audience.

In the context of JAP, the ECOWindS partners as industry associations are a natural choice to mediate and facilitate, but especially when it comes to legitimising the JAP and the associated goals, industry leading figures delivering the address are much more effective than industry association workers. The following questions should be considered when preparing:

1. What does the audience know?
3. Why are they in the room?
4. Predispositions about your topic?
5. What are they feeling, what do you want them to feel?
6. What are their values and cultural background?
7. How can you help your audience to reach their goals?
8. Who should be talking?

Personal tailoring is possible in practice only on one-to-one or small group meetings. For larger audiences and presentations, tailoring the content becomes more difficult and the question becomes should the presentation be addressed to a generic or average person in the room, or is there a possibility to identify the key decision makers who are expected to attend the presentation and address their decision making style.

To target the message for audiences, it is important to identify gate keepers and decision makers in the audience and deliver the message to their needs. In personal communication and small groups, it is important to recognise that decision makers have a different preference in terms of risk taking, facts and emotive content. Thus it is important to recognise that different techniques are needed for different audiences. For risk-averse decision makers providing examples and analogies of successful leaders that have done similar decision in the past pave the way to a decision, for charismatic decision makers a lucrative and emotive

pitch is the key and for analytical decision makers solid facts and a good business case make all the difference. (e.g. Williams & Miller, 2002)

Related to the audience is the message that is delivered. In the context of the JAP, there are two generic messages. First is the content of the JAP, including the individual actions and the overall rationale and 'story'. This message is aimed to persuade stakeholders to commit to the actions in order to advance OWS towards the general goals. This message can take two generic forms, either bottom up from the actions and their rationale to the contribution to the bigger picture, or top down from commitment to the general goals and drawing the link to the actions and their contribution. This message of 'selling' the JAP to the stakeholders is expected to be prevalent in the immediate term after the launch.

Second is the message of the success stories of ECOWindS and specifically JAP-related activities. This message is aimed to reinforce commitment to the JAP goals and the actions and identification to OWS industry in general. The generic form of the message is disseminating projects and other activities that are related to, inspired by, or actually implement the JAP and specifically mentioning the ECOWindS JAP as a part of that massage. Delivering this message creates a virtuous cycle by letting the stakeholders know the JAP is a portfolio that moves on and contributes to the industry, which makes committing to it easier for all types of decision makers. It is expected that this second message will be more prevalent when the JAP implementation starts taking off.

The last general principle is integrating the communication to ECOWindS partners' and later post-ECOWindS collaborators activities. First, insofar as the JAP is a common portfolio of RDI for the OWS industry, it should be appropriated as a core program by the partners. Additionally, especially during post-ECOWindS collaboration, integrating the JAP communication to the mainline of the activities makes it more sustainable by eliminating JAP as a separate burden.

Target groups

As discussed above in the introduction, the main audiences of the JAP include following the triple helix logic enterprises in the OWS industry, relevant researchers, as well as policy makers and civil servants who deal with issues relevant to OWS. Next we define these groups closer:

- *Enterprises in the OWS industry* include at least two tiers of enterprises. The first tier comprises the enterprises that work directly in OWS value chains at the moment. The second tier includes enterprises with relevant capabilities to contribute to OWS value chain and relevant RDI. These include enterprises in industries including but not limited to ship building, lifting and hoisting, wind farm component design and manufacture, marine construction and engineering. The significance of these second tier enterprises needs to be defined case by case based on their capabilities and interest to contribute to OWS activities and value chains.
- *Relevant researchers* include researchers in relevant scientific and engineering disciplines not limited to wind power such as mechanical engineering, electrical engineering, naval architecture, supply chain management and logistics, operations research/management.
- *Policy makers and civil servants* include those policy makers, who oversee energy policy, RDI policy and environmental policy, as well as occupational health and

safety, and the civil servants who design and implement legislation, regulation and policy instruments that are relevant for the OWS industry.

Communication channels and media

The communication channels identified in ECOWindS D7.1 are relevant for the JAP. The media include articles, interviews, presentations and social media posts:

- *Trade and professional magazines for offshore wind and associated industries* (New Energy, Windpower Monthly, Renewable Energy World, Renewable Energy Focus, Offshore Wind, Offshore Wind Engineering, Offshore Wind Journal, Renewable Energies, Sun, Wind & Energy, Offshore Wind Industry, TradeWinds etc.) target the core stakeholders of OWS industry. They are suitable for technical pieces related to the actions and JAP in general as well as disseminating results related to JAP. These channels are most suited for inducing commitment to the goals and actions of the JAP.
- *Daily newspapers and magazines* (National newspapers such as Frankfurter Allgemeine, Berlingske, The Times, Aftenposten, business dailies like Financial Times and Børsen, as well as regional newspapers) capture a wide audience including policy makers. They are suitable for interviews and op-ed pieces that help legitimise offshore wind and OWS through dissemination of positive development in the JAP and LCoE.
- *Academic (peer reviewed) journals* (Energy Policy, Renewable Energy, Wind Energy, Journal of Cleaner Production, IEEE Transactions on Sustainable Energy, as well as domain specific journal for e.g. naval architecture and marine engineering, shipbuilding, logistics, operations management, O&M etc.) reach prevalently academic audiences and are suited to attract researchers' attention to the JAP and the results. The main message for this channel are the technically and otherwise academically significant findings from RDI actions.
- *Trade shows and professional conferences* (EWEA Annual Event, EWEA Offshore, Windforce, Renewable UK etc.) are analogous to trade magazines and reach a wide audience of stakeholders. They are suited for attracting partners to the actions and disseminating results as well as gathering stakeholder input for updating the JAP.
- *Academic conferences* again mirror journals in their target audience. Conferences are suited for publishing smaller RDI results and findings, as well as projects presentations. Conferences are also an excellent platform for attracting research partners to the actions.
- *Social media and networking platforms* (Facebook, LinkedIn, Twitter, ResearchGate, Blogs, etc.) potentially reach all different stakeholders, while the actual targeting depends on the network characteristics of the communicator. The possible message includes both the JAP contents as well as all significant collaborations and results related to the JAP, as well as advertisement of the messages delivered in all of the above media.

The specific targets for communication are that the JAP under ECOWindS and post-ECOWindS collaboration should be mentioned at least once in a major tradeshow, e.g. EWEA Annual Event or EWEA Offshore as a source to a major action. The JAP in general should feature in all regional trade magazines at least once a year and all JAP actions should be disseminated either in trade magazines or conferences at least once. JAP should

mentioned when relevant in other communication the partners do in daily and periodical newspapers and magazines.

All communication should identify the ECOWindS and the JAP. Also to make full use of the internet and search engines, all communication should include consistent keywords offshore wind services, OWS, ECOWindS, Joint Action Plan and JAP in speech or writing. All communications should be linked to and or cached to the ECOWindS website and linked to other websites and blogs as well as (searchable) social media posts that include the keywords. (see. e.g. Burger, 2014)

5. Conclusion

This report has presented the ECOWindS projects' Joint Action Plan (JAP), a roadmap for research, development, and innovation (RDI) for the Offshore Wind Service (OWS) industry. The objective of the JAP is to be an international, cross-regional, agenda for research, development and innovation specifically for Offshore Wind *Services*. It has been recognized in the ECOWindS project that while there are several projects on various aspects of offshore wind in general, relatively little attention has been devoted to OWS specifically. The JAP fills this gap by complementing existing RDI plans with special regard to services, thus enabling the last push for reaching grid parity in terms of LCoE.

OWS is a key industry that is very important to financial and technical sustainability of the rapidly expanding Offshore Wind industry. The JAP is an agenda for collaboration *specifically* for Offshore Wind *Services,* aimed to develop new and improved OWS business models, technologies and other concepts in support of general offshore wind cost reduction targets. The audience of the JAP is threefold, it includes offshore wind industry constituents, research institutions and policy makers who set the framework conditions for offshore win and OWS. The core of the JAP are the following eight actions (Table 4).

Table 4: Summary of the actions

No.	Action	Purpose	Rationale
1	Establish a long lasting joint initiative for knowledge sharing and innovation between regions	The purpose of this activity is to support OWS specific collaboration and to complement the existing collaboration efforts by focusing on international and cross regional collaboration by bridging existing regional platforms to enable new business collaboration across regional and cluster borders.	The OWS industry is early in development and still fragmented. Grasping the collaboration opportunities and leveraging the complementary assets between industry constituents as well as relevant research are needed to realize the growth potential for and value of OWS. Thus existing efforts need complementing with added focus on OWS specific topics and international collaboration.
2	Develop a value proposition for OWS as an industry in itself	Stakeholders need to understand the value created specifically by OWS within the framework of offshore wind. Today the OWS value chain is fragmented as the actors identify with different industries. Recognising OWS as an industry enables capturing synergies and consolidation over old industry boundaries.	Improve communication within and outside OW/-S industry by developing a clear brand message for OWS tailored for various stakeholders for OWS and establishing a communication platform for delivering the message.

No.	Action	Purpose	Rationale
3	Develop OWS specific mission-oriented research, development and innovation program	There is a need for R&D to lower the cost of offshore wind energy. Common agreement over the specific industry goals and finding mutual interests and collaboration opportunities leading up to cost reduction in OWS Increased knowledge, new technology and new business opportunities are needed.	Develop a problem driven and *OWS specific* international research program with clear priorities and a focus on generic large scale technologies which are important for OWS and are not featured on existing research agendas, e.g. TPWind, where collaboration has significant benefit.
4	Drive for international OWS specific standards	Standards enable incremental cost reductions in OWS value chain and offer the possibility to drive for economies of scale in manufacturing and O&M through industry standards. The long-term result is less complexity in wind farm planning, installation and maintenance, incremental cost reductions.	Provide a platform for technical standardization and drive emerging industry standards towards official status in key areas, building on the short term actions and building relations towards the future.
5	Develop OWS specific skills and training programs across regions	OWS specific training programs and qualifications contribute to availability of skilled and qualified workers for the demanding OWS tasks and improves labour mobility. Better labour mobility enables flexible OWS, lessens local labour shortages and leads to incremental gains in O&M cost.	Harmonize skills and Occupational Health and Safety requirements and certifications for OWS across EU. Develop EU-wide economically and socially sustainable common qualifications and certifications for OWS workers to complement the existing GWO standards. Develop matching international training programs.
6	Develop an OWS Industry Database	Development of new business across the regions and optimization of existing services through collaboration need comprehensive solutions for information exchange. The industry database/portal aggregates knowledge relevant specifically for OWS to facilitate collaboration and knowledge sharing in operations and RDI for OWS	Support development of OWS services and the emergence of international networks by aggregating relevant knowledge to understand what are the challenges and problems to solve.
7	Establish OWS Specific Test Sites and Research Infrastructure	Increased experience and knowledge about reliability and maintenance need of new technologies; development and testing of new installation and O&M procedures and technologies; develop and test wind farm concepts – leading up to lower life-cycle cost in large scale installations Innovation leading to lower lice-cycle cost/LCoE.	Build international offshore test sites for new offshore specific technologies, using existing infrastructures onshore and offshore where appropriate.

No.	Action	Purpose	Rationale
8	Drive regulatory harmonization on Occupational Health & Safety	Harmonization of regulation on OH&S improves mobility of skilled workers and allows flexibility for OWS without endangering personnel or equipment. Better labour mobility enables flexible OWS, lessens local labour shortages and leads to incremental gains in O&M cost.	Develop EU-wide common qualifications and certifications for OWS workers across jurisdictions.

The JAP is a complement to other research agendas on wind power presented or under development by other organizations by approaching the challenges of offshore wind from the service perspective. These collaborations and the strategies focus on a broad front of technology related to the wind turbines, electric infrastructure, grid integration etc., while the ECOWindS JAP explicitly and specifically focuses on the services for offshore wind farm installation, operation and maintenance. To summarize the key messages of the JAP and to pave the way to a successful future of OWS, we round out the discussion by reinforcing some of the key points.

Rally around the vision for stronger offshore wind services

Taken altogether, the vision associated with the JAP is that by 2020 OWS is a recognized industry with strong networks around the Globe and especially the North Sea. By that time the installed offshore wind capacity has multiplied, and as a consequence of the industrialisation and purposeful RDI and standardization efforts the key components have been standardised to an extent that enables smooth installation, interoperability between components, and efficient O&M services.

At the heart of this fruitful progress are strong networks and confidential relationships along the value chain, that enable optimizing the delivery of value through the whole life cycle of the wind farm from the factory door to end of life. These networks involve the key stakeholders from operators and developers to turbine and grid component manufacturers, load handling and hauling enterprises who handle the components, to the offshore service enterprises who install and maintain the farms when installed. Within the network everyone knows their added value and receives relevant information that enables them to continue to deliver value to the farm. This state where the actors trust each other and work for a common goal is worth investing for, as it gives a strong basis for the North Sea clusters to compete on a Global scale.

Leverage the close ties and proximity of actors around the North Sea for purposeful RDI

As the OWS network is born, it is time to leverage it to capture the opportunities that RDI can bring. The central storyline of the JAP is that through development of inter-regional interconnections, the OWS enterprises gain complementary capabilities and are able to deliver new and improved services for the operators. At the same time the networking that creates closer business relations enables quicker and more candid feedback within the whole offshore wind ecosystem, enabling standardization of components, processes and

practices, which lays foundations for the continuous improvement of the OWS service delivery.

This in turn supports the program of innovation and continuous improvement that drives all the stakeholders towards interoperability and standardisation on one hand, and bold innovation and experimentation on the other. This purposeful innovation program streamlines installation and O&M of the new farms to an extent that enables delivering cheap clean power reliably. Finally, as always, the success of OWS relies on a skilled and motivated workforce who can deliver value in every aspect of the value chain from research, development, engineering through transport to installation and O&M.

Pay attention to building the actions and follow through to implementation

In general the assumption is that the JAP is managed by a post-ECOWindS collaboration, who will facilitate initiation of the actions and consortium building. The consortium members depend on the action. However, a general recommendation is to involve stakeholders along the value chain from OWS contractors, and suppliers through OEMs to operators. Incidentally these actions also serve as a platform for further collaboration towards the goals of the JAP and industry. The general condition is to build a strong consortium for each action with the ability to implement it effectively and with the interest to drive it forwards. The latter essentially mean that from the start the consortium members for each action should be aligned in their interest towards the action.

In general the actions are the type that a broad based consortium, involving industry, research, education, and public administration is needed for successful implementation. The actions do generally fall into the categories of RDI and business development. The role of the ECOWindS partners and later the post-ECOWindS collaboration was discussed above, and it is to lay a foundation on certain actions and to act as a facilitator to form appropriate consortia to implement the actions. Another general principle is to include partners across regions including but not limited to the ECOWindS regions. The rationale is to leverage the best capabilities to enable mutual learning across European regions. Further, international scope of the projects enables attracting a wider base of funding, as well as an impact.

Keep the JAP alive with consistent communication and monitoring

The JAP needs to be integrated to the ECOWindS partners' and later post-ECOWindS collaborators activities. First, insofar as the JAP is a common portfolio of RDI for the OWS industry, it should be appropriated as a core program by the partners. Additionally, especially during post-ECOWindS collaboration, integrating the JAP communication to the mainline of the activities makes it more sustainable by eliminating JAP as a separate burden.

As a general principle, all communication should identify the ECOWindS and the JAP. Also to make full use of the internet and search engines, all communication should include consistent keywords offshore wind services, OWS, ECOWindS, Joint Action Plan and JAP in speech or writing. All communications should be linked to and or cached to the ECOWindS website and linked to other websites and blogs as well as (searchable) social media posts that include the keywords.

The principles for communicating the JAP include tailoring the delivery of the message to the audience and situation. The JAP is delivered in this report as a one-size-fit-all solution. However, to support the implementation of the JAP, the message needs to be tailored for the audience in terms of their interests, knowledge and as far as possible personal style of decision making. The key to effective presentation is adapting the substantive content to the knowledge level of the audience as well as the emotive content to suit the situation and 'room temperature'. Another aspect of tailoring the presentation to an audience is choosing who delivers the message to which audience.

From the onset, the first message is the content of the JAP, including the individual actions and the overall rationale and 'story'. This message is aimed to persuade stakeholders to commit to the actions in order to advance OWS towards the general goals. However, as time passes the more important message will be the success stories of ECOWindS and specifically JAP-related activities. This message is aimed to reinforce commitment to the JAP goals and the actions and identification to OWS industry in general. The generic form of the message is disseminating projects and other activities that are related to, inspired by of actually implement the JAP and specifically mentioning the ECOWindS JAP as a part of that massage. Delivering this message creates a virtuous cycle by letting the stakeholders know the JAP is a portfolio that moves on and contributes to the industry, which makes committing to it easier for all types of decision makers. It is expected that this second message will be more prevalent when the JAP implementation starts taking off.

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ANNEX A: Detailed Actions

Table 5: Key to the action template

Template Item	Definition and/or guiding questions
Action title	Title of the action
Timing	When is the action to be implemented? Start year (and quarter), end year (and quarter)
Type	What is the type/main content of the action? RDI = problem driven Research Development and Innovation IND= Business and industry development actions, including common infrastructure POL= RDI and industrial policy actions, improvement to framework conditions
Implementation level	What is the expected level of implementation? International/European/National/Regional
Stakeholders	Stakeholders **of the action**, including separately (where relevant): *Implementers*: Who will do the work and implement the action? *Stakeholders:* Whose decisions moderate the impact of the action? Who have an interest in the action? Who will hold stake in the action, in terms of benefit, involvement, investment?
Rationale	The rationale/need for the action
Purpose	Goals of the action
Activities	*Activities* What steps does the action comprise? What are the stages of implementation? *Milestones* Intermediary deliverables
Deliverables	What is the direct output of the action?
Anticipated impact	Anticipated impacts to future OWS What do the outcomes matter? Indicators for verifying the actions' success
Resources	*Action volume* How much time it takes and how much work is expected to be involved? *Funding/financing source* Who will invest? Funders

<table>
<tr><td>Action No.</td><td>1</td><td colspan="2"></td><td>Start</td><td>2015</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td>End</td><td>-</td></tr>
<tr><td>Action Title</td><td colspan="3">Establish a long lasting joint initiative for knowledge sharing and innovation between regions</td><td>Type</td><td>IND</td></tr>
<tr><td></td><td colspan="3"></td><td>Level</td><td>International/ European</td></tr>
<tr><td rowspan="2">Stakeholders</td><td>Implementer</td><td colspan="4">A post-ECOWindS collaboration of European offshore wind and OWS cluster organizations and industry associations</td></tr>
<tr><td>Stakeholders</td><td colspan="4">OWS industry, together with related industries, such as traditional maritime, offshore, Oil & Gas support industry etc.</td></tr>
<tr><td colspan="6">Description</td></tr>
<tr><td>Rationale</td><td colspan="5">The OWS industry is early in development and still fragmented. Grasping the collaboration opportunities and leveraging the complementary assets between industry constituents as well as relevant research are needed to realize the growth potential for and value of OWS. Thus exiting efforts need complementing with added focus on OWS specific topics and international collaboration.</td></tr>
<tr><td>Purpose</td><td colspan="5">While there are multiple activities going on especially on national or cluster level and related to the general offshore wind industry, the purpose of this activity is on the one hand to support OWS specific collaboration and topics and on the other to complement the existing collaboration efforts by focusing on international and cross regional collaboration by bridging existing regional platforms and creating new if needed, to enable new business collaboration across regional and cluster borders.</td></tr>
<tr><td rowspan="2">Activities</td><td colspan="5">Activities</td></tr>
<tr><td colspan="5">Consolidate existing innovation and knowledge sharing activities and platforms
- Establish a long-lasting Post-ECOWindS OWS-specific cluster management consortium to coordinate innovation and knowledge sharing on OWS on international level
- Establish a solid relationship between post-ECOWindS OWS collaboration, GWO, EWEA and national industry associations
- Catalog and advertise regional and national networking events, e.g. WAB Stammtisch in DE, State of Green events in DK
- Bring international and OWS-specific themes to existing networks and events

Develop an innovation and knowledge sharing platform to deliver following (types of) activities to complement existing:
- specific event concepts for regular implementation, e.g. business rendez-vouz; industry-research technical forums, roundtables or workshops, to discuss ideas, challenges and ongoing projects – specifically for stakeholder groups, e.g. operators and OWS providers etc.
- EU-level industry-research Working Groups on most important OWS problems and Knowledge Sharing Circles to exchange of best practices
- Match-making service for operators, investors, financiers, developers etc.
- Organize cross-regional OWS Study Trips to existing and new offshore sites
- Set-up schemes for B2B staff exchanges, resident scientist, apprenticeships, trainee programs and industrial PhDs
- Encourage joint venturing, joint projects and collaborative RDI e.g. under EUROSTARS and H2020

Guidelines
- Use existing conferences and other events to work with cross cluster networking
- Do not come up with new events just for the sake of new events
- Build relationships with complementary industries, e.g. maritime, offshore, wind service, OEMs
- Strive for well-prepared, decision-focused and regular activity</td></tr>
<tr><td></td><td colspan="5">Milestones</td></tr>
<tr><td></td><td colspan="5">At least three initiatives from the list chosen and initiated</td></tr>
</table>

Deliverables	International/cross cluster innovation and knowledge sharing platform that delivers networking and knowledge exchange activities	
Anticipated impact	Impact	Stronger networks within the industry, that lead up to new business potential and innovation towards more effective services
	Indicators	Number of participants in meeting, attendant retention/number of repeat customers in meeting Number of new collaborations, joint projects and other venture between regions No. of same along the value chain and outside the core cluster
Resources	Action volume	
	Adjacent to action 1, 50k EUR for design of specific , 1 full-time equivalent (FTE) sustained after the first year, 15k EUR per year for events and publications	
	Funding/financing sources	
	Industry associations, possible national project funding for the kick-off	

<table>
<tr><td>Action No.</td><td>2</td><td colspan="2"></td><td>Start</td><td>2015</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td>End</td><td>2017</td></tr>
<tr><td>Action Title</td><td colspan="3">Develop a value proposition for OWS as an industry in itself</td><td>Type</td><td>IND</td></tr>
<tr><td></td><td colspan="3"></td><td>Level</td><td>International/ European</td></tr>
<tr><td rowspan="2">Stakeholders</td><td>Implementer</td><td colspan="4">A post-ECOWindS Collaboration</td></tr>
<tr><td>Stakeholders</td><td colspan="4">Stakeholders of OWS industry and industry constituents</td></tr>
<tr><td colspan="6">Description</td></tr>
<tr><td>Rationale</td><td colspan="5">OWS needs to be recognized as an industry in itself:
Stakeholders need to understand the value created specifically by OWS within the framework of offshore wind. Today the OWS value chain is fragmented as the actors identify with different industries. Recognising OWS as an industry enables capturing synergies and consolidation over old industry boundaries.
Financiers need to understand the challenges and risks associated with OWS operations need to be better understood to secure finance and other support.
OWS is comprises a large number of relatively small enterprises at the moment and many operations are situated near offshore wind farms, which makes OWS a potential target for regional policy. This needs to be communicated to policy makers. Additionally recruitment of skilled workers needs a clear value proposition.</td></tr>
<tr><td>Purpose</td><td colspan="5">Improve communication within and outside OW/-S industry by developing a clear brand message for OWS tailored for various stakeholders for OWS and establishing a communication platform for delivering the message.</td></tr>
<tr><td rowspan="4">Activities</td><td colspan="5">Activities</td></tr>
<tr><td colspan="5">Improve communication platforms across EU and industry
- Share lobbying between clusters
- Recognize the best practices from existing platform and apply them to OWS context
Develop a clear brand message for OWS as an industry focusing on
- OWS as an industry in itself
- added value of OWS
- local strengths and business opportunities</td></tr>
<tr><td colspan="5">Milestones</td></tr>
<tr><td colspan="5">Existing OWS communication platforms identified and a communication niche for OWS set
Goals and standards for communication set
A brand message, materials and communication plan for OWS devised
Industry value added, strengths, weakness, needs and opportunities formulated</td></tr>
<tr><td>Deliverables</td><td colspan="5">International communication platform and channel for OWS industry
A brand message for OWS industry</td></tr>
<tr><td>Anticipated impact</td><td>Impact</td><td colspan="4">Increased visibility and better understanding of OWS enterprises needs and challenges within and outside the industry enables effective communication with stakeholders
A clear positive depiction of What is OWS sector and what is its significance for renewable energy in general and offshore wind in particular
A clear brand and value proposition also improves ability of attracting skilled labour
OWS industry has a distinct business identity/brand and own track in conferences and trade shows</td></tr>
</table>

	Indicators	Recognition of OWS as an industry unto itself within the framework of offshore wind by the industry constituents and other stakeholders - Brand recognition of OWS industry, change during first three years OWS stakeholders recognize and use the same clear argument for the value of OWS industry - Analysis of communications, substantive content of selling arguments
Resources	**Action volume**	
	Kick-off stage, approx. 100-200 k EUR as a project Maintaining communication as a part of industry associations routine operation, approx. one-half FTE per year	
	Funding/financing sources	
	EU, industry/trade associations	

<table>
<tr><td>Action No.</td><td>3</td><td colspan="2"></td><td>Start</td><td>2016</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td>End</td><td>-</td></tr>
<tr><td>Action Title</td><td colspan="3">Develop OWS specific mission-oriented research, development and innovation program</td><td>Type</td><td>RDI</td></tr>
<tr><td></td><td colspan="3"></td><td>Level</td><td>International</td></tr>
<tr><td rowspan="2">Stakeholders</td><td>Implementer</td><td colspan="4">A post-ECOWindS Collaboration with operators, network engine businesses and research institutions</td></tr>
<tr><td>Stakeholders</td><td colspan="4">OWS industry: Operators, OWS providers, OEMs, Research institution-industry consortia, industry associations, relevant other industries</td></tr>
<tr><td colspan="6">Description</td></tr>
<tr><td>Rationale</td><td colspan="5">There is a need for R&D to lower the cost of offshore wind energy. Common agreement over the specific industry goals and finding mutual interests and collaboration opportunities leading up to cost reduction in OWS Increased knowledge, new technology and new business opportunities are needed</td></tr>
<tr><td>Purpose</td><td colspan="5">Develop a problem driven and OWS specific international research program with clear priorities and a focus on generic large scale technologies which are important for OWS and are not featured on existing research agendas, e.g. TPWind, where collaboration has significant benefit.</td></tr>
<tr><td rowspan="4">Activities</td><td colspan="5">Activities</td></tr>
<tr><td colspan="5">Develop industry priorities
- Select the priorities for the research program based on ECOWindS
Build consortia around the priorities
- Recognize positioning and the competences of research institutions and enterprises
- Build consortia with appropriate capability to achieve the goals
- Match public R&D subsidies/funding instruments to consortia
A list of R&D topics collected from industry stakeholders in the JAP workshop:
- Keep an open dialogue of relevant technical problems and research topics (c.f ECOWindS D6.1-3)</td></tr>
<tr><td colspan="5">Milestones</td></tr>
<tr><td colspan="5">R&D priorities set
Consortia identified and set
Consortia formed around at least three key ideas
1-page project proposal developed and possible funding scoped</td></tr>
<tr><td>Deliverables</td><td colspan="5">At least three new R&D&I project proposals on key topics</td></tr>
<tr><td rowspan="2">Anticipated impact</td><td>Impact</td><td colspan="4">Common understanding on the goals and direction of R&D, leading to pooling resources and better use of complementary assets. New solutions with lower cost for operation over the life-cycle of wind farms.
New research-based solutions/technologies to key OWS problems in mid-to-long term</td></tr>
<tr><td>Indicators</td><td colspan="4">At least three consortia formed by 2015
At least one project kicked off 2016</td></tr>
<tr><td rowspan="3">Resources</td><td colspan="5">Action volume</td></tr>
<tr><td colspan="5">300k EUR as a project
Some action towards collecting consortia based on initial ideas is foreseen within ECOWindS project WP5-6. Otherwise part of industry association normal operations</td></tr>
<tr><td colspan="5">Funding/financing sources</td></tr>
</table>

	Industry associations, EU EU and various national funding instruments

<table>
<tr><td>Action No.</td><td>4</td><td colspan="2"></td><td>Start</td><td>2017</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td>End</td><td>-</td></tr>
<tr><td>Action Title</td><td colspan="3">Drive for international OWS specific standards</td><td>Type</td><td>IND</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td>Level</td><td>International</td></tr>
<tr><td rowspan="2">Stakeholders</td><td>Implementer</td><td colspan="4">A post ECOWindS collaboration with network engines</td></tr>
<tr><td>Stakeholders</td><td colspan="4">OWS industry; turbine manufacturers and other OEMs, regulators, operators, maritime classification companies such as DNV-GL, Lloyds OWS industry</td></tr>
<tr><td colspan="6">Description</td></tr>
<tr><td>Rationale</td><td colspan="5">Standards enable incremental cost reductions in OWS value chain and offer the possibility to drive for economies of scale in manufacturing and O&M through industry standards. The long-term result is less complexity in wind farm planning, installation and maintenance, incremental cost reductions.</td></tr>
<tr><td>Purpose</td><td colspan="5">Provide a platform for technical standardization and drive emerging industry standards towards official status in key areas, building on the short term actions and building relations towards the future.</td></tr>
<tr><td rowspan="2">Activities</td><td colspan="5">Activities</td></tr>
<tr><td colspan="5">Review of existing national and international certifications, standards and on-going standardization processes
- What has been achieved within industry
- What are the pressing issues
- List of standardization topics and priorities/urgency
Develop standards management procedures and informal standards working groups/committees, building on action for industry standards (Action 4)
- Pick up on previous actions on industry standards and form proposed standards working groups, e.g. IEC TC88 on wind turbines
- Drive forwards to ISO/EN on selected specifically OWS related topics by developing a progressively better standards proposal, gathering industry support and proposing a new working group or taking the standard to ISO
Organize cross-regional industry workshops on standardization building on industry collaborations (action 2) that will:
- Encourage operators to drive standardization, cf. Dong initiative for standard wind farm and standard substation, and interfaces such as standard bolt circle diameter and pattern for tower bases for ease of installation etc.
- Facilitate OEMs and suppliers in selecting standard subassemblies for e.g. transformers, frequency converters, cabling
- Facilitate integration of OWS value chain through networking and partnering
- Lead up to formation of standards working groups (see Action 8)
Proposed topics for industry standardization
- Interfaces (technical, mechanical, data/EDI)
- Project practices and documentation, processes and Health, Safety & Environmental Reviews (see Action 8)
- Supply chain and O&M value network
- Grid parameters, e.g. voltage, (frequency,) cabling, connectors
- Vessel classes</td></tr>
<tr><td>Milestones</td></tr>
<tr><td colspan="5">State of the art in standardization reviewed and topics narrowed down
Workshop topics and invitees chosen, workshops planned
Workshops delivered
Stable working groups formed
Three key standardizing initiatives chosen
Committees and topics proposed to ISO/EN
Initial drafts for standards specification</td></tr>
</table>

Deliverables	Sustainable industry working groups on key industry standards for OWS informal standards committees on key issues in OWS Standards specification (drafts) for key technical issues Official standards for key aspects of OWS, leading to lower complexity and incremental gains in LCoE	
Anticipated impact	Impact	Collaboration networks and working groups for standardization (European) Industry standards on OWS relevant topics
	Indicators	At least one standards working group by 2017 At least one standards proposal in draft by 2018
Resources	Action volume	
	6 month FTE for state-of-the-art review and planning the workshops Up to 50k EUR per workshops in venue, catering and travel expenses 50k EUR for analysis building on Action 4, 30k EUR for workshops	
	Funding/financing sources	
	Private, national funding Private funding, EU H2020 Coordination and Support Action	

<table>
<tr><td>Action No.</td><td>5</td><td></td><td>Start</td><td>2015</td></tr>
<tr><td></td><td></td><td></td><td>End</td><td>2019</td></tr>
<tr><td>Action Title</td><td colspan="2">Develop OWS specific skills and training programs across regions</td><td>Type</td><td>IND/RDI</td></tr>
<tr><td></td><td colspan="2"></td><td>Level</td><td>Int'l/National</td></tr>
<tr><td>Stakeholders</td><td>Implementer</td><td colspan="3">Post-ECOWINDS Collaboration, GWO, Educators</td></tr>
<tr><td></td><td>Stakeholders</td><td colspan="3">OWS industry, Labour Unions, Occupational Health and Safety regulators, employers, education providers, Network engines/OEMs</td></tr>
<tr><td colspan="5">Description</td></tr>
<tr><td>Rationale</td><td colspan="4">OWS specific training programs and qualifications contribute to availability of skilled and qualified workers for the demanding OWS tasks and improves labour mobility. Better labour mobility enables flexible OWS, lessens local labour shortages and leads to incremental gains in O&M cost.</td></tr>
<tr><td>Purpose e</td><td colspan="4">Harmonize skills and Occupational Health and Safety requirements and certifications for OWS across EU. Develop EU-wide economically and socially sustainable common qualifications and certifications for OWS workers to complement the existing GWO standards. Develop matching international training programs.</td></tr>
<tr><td>Activities</td><td colspan="4">Activities
Outline existing skills gaps and specific training needs for OWS
- Survey available skills and workforce
- Establish a (qualitative) profile for skills and certifications/qualifications needed in OWS
- Establish a (quantitative) estimate of future needs for skills and certificates
- Survey existing vocational education, training and qualifications programs and capacity, as well as graduate career paths
- Survey and compare existing certifications and qualifications
- Develop a "skills gap", picture of differences and overlaps with current skills and future industry needs
- Facilitate harmonization of qualifications/certifications
Establish guidelines for developing/harmonizing skills, certificates/qualifications
- Harmonized curriculum for training with OWS specific skills
- Harmonized skills and qualifications for OWS tasks
Gather a working group to develop training programs and EU-wide qualifications
- Include relevant policy makers, regulators, industry network engines, educational institutions and labour unions to develop an EU wide qualifications program
- Work towards harmonization of qualifications and certifications
Survey state of the art for required national and private/proprietary qualifications
- Analyze content and find overlaps and significant differences
- Build on the previous action on skills recognizing industry needs
- Define key skills and (informal) qualifications and certificates for the key job descriptions in OWS
Choose relevant stakeholders
- Survey key stakeholders in keystone Member States including national education and occupational health and safety regulators, largest employers, relevant labor unions and key policy makers/politicians
Develop working groups with stakeholders, including OEMs, OWS providers and national authorities/regulators, policy makers, educational institutions and labor unions, to harmonize
- Basic qualifications related to OWS
- Certificates not related directly technical details of specific equipment
- Develop draft EU-qualifications program
- Coordinate with GWO OH&S guidelines

Milestones</td></tr>
</table>

	Skills gap recognized Job descriptions and key skills and qualifications determined Proposed curricula, career paths, qualifications and certifications decided Needs for qualifications and certificates established Qualitative differences and overlaps in certificates established Guidelines for harmonized training and certifications established	
Deliverables	EU-wide guidelines for OWS education, training and qualifications Progress towards harmonization of qualifications and certificates for OWS workforce Proposal for qualifications and certificates path/program for specifically OWS workers submitted to European Commission and/or national policy makers and regulators - Vocational training and degrees path as well as continuing education/life-long learning paths Draft curricula, qualifications and certificates for key job descriptions	
Anticipated impact	Impact	Economies of scale and incremental cost reduction in OWS Secure skills for OWS in the future Increased labor mobility and flexibility for OWS
	Indicators	At least one OWS specific training program set by 2016
Resources	Action volume	
	500k EUR for the skills gap analysis and design of necessary programs	
	Funding/financing sources	
	National funding for education and training; ERDF/ESF, industry, EU H2020 Coordination and Support Action	

<table>
<tr><td>Action No.</td><td>6</td><td></td><td>Start</td><td>2017</td></tr>
<tr><td></td><td></td><td></td><td>End</td><td>2019</td></tr>
<tr><td>Action Title</td><td colspan="2">Develop an OWS Industry Database</td><td>Type</td><td>IND/RDI</td></tr>
<tr><td></td><td></td><td></td><td>Level</td><td>International</td></tr>
<tr><td>Stakeholders</td><td>Implementer</td><td colspan="3">Post-ECOWINDS Collaboration Industry associations, network engines</td></tr>
<tr><td></td><td>Stakeholders</td><td colspan="3">OWS industry</td></tr>
<tr><td colspan="5">Description</td></tr>
<tr><td>Rationale</td><td colspan="4">Development of new business across the regions and optimization of existing services through collaboration need comprehensive solutions for information exchange. The industry database/portal aggregates knowledge relevant specifically for OWS to facilitate collaboration and knowledge sharing in operations and RDI for OWS</td></tr>
<tr><td>Purpose</td><td colspan="4">Support development of OWS services and the emergence of international networks by aggregating relevant knowledge to understand what are the challenges and problems to solve.</td></tr>
<tr><td rowspan="2">Activities</td><td colspan="4">Activities</td></tr>
<tr><td colspan="4">Agree between clusters and on EU level on ground rules
- Access rights, business model (subscription, membership etc.)
- Information security procedures
- Ownership of data and derivatives thereof
Agree on administration and technical implementation of the database
- Standard data formats and EDI
- Reporting/uploading requirements for operators, OWS partners, OEMs etc. and agreements
- Funding/business model for the database
- Develop analyses and models to make sense of the available data
Survey existing databases and seek integration/collaboration
- SPARTA and Catapult (UK)
- Fraunhofer IWES and OWMEP (DE)
- ECN (NL)
- Offshoreenergy.dk Knowledge (earlier LORC Knowledge, DK)
- MAKE (DK)
Data to archive and/or integrate
- EU wide/cross-cluster RDI project inventory to distribute knowledge and prevent doubling
- OWS infrastructure catalog including harbors and harbor infrastructure, cranes; vessels; access roadways and infrastructure
- Anonymized O&M data on running farms, fault types and frequencies, O&M costs and contract types
- Overview of national/EU and global OWS markets
- Meteorological and wind survey data (covered to a large extent with European Centre for Medium-Range Weather Forecasts (ECMWF) and NCEP/NCAR reanalysis data)
- Topographical, soil and bottom survey data (to a large extent covered by NASA/Jet Propulsion Laboratory (JPL) Shuttle Radar Topography Mission (SRTM, data exclude bathymetry) and the United States National Oceanic and Atmospheric Administration (NOAA) ETOPO1 Historic Relief data)
Develop projects to analyze and use the existing data
- Develop interesting questions with stakeholders and collaborate with researchers to develop and fine tune analyses</td></tr>
<tr><td colspan="4">Milestones</td></tr>
</table>

	Agreement on IP ownership and access rights Administration and technical implementation set Business model for the database At least three projects initiated on data mining/analysis	
Deliverables	OWS specific industry database and portal	
Anticipated impact	Impact	New business and RDI opportunities, exchange of best practices enables incremental gains in lowering LCoE
	Indicators	Database/portal on line Coverage of key data sources around the North Sea Daily visits break 1000 hits
Resources	Action volume	
	Technical set-up and design of portal 50-100k EUR, web/database hosting 3-12k EUR per year if not hosted/administered on existing servers Content set-up 100-500k EUR as a project Content license fees 1 MEUR Database content administration 0,25-0,5 FTE by industry associations	
	Funding/financing sources	
	To be decided between public funding, private funding and subscription fees	

<table>
<tr><td>Action No.</td><td>7</td><td colspan="2"></td><td>Start</td><td>2017</td></tr>
<tr><td rowspan="2">Action Title</td><td colspan="3" rowspan="2">Establish OWS Specific Test Sites and Research Infrastructure</td><td>End</td><td>2022</td></tr>
<tr><td>Type</td><td>IND-RDI</td></tr>
<tr><td>Level</td><td>International</td></tr>
<tr><td rowspan="2">Stakeholders</td><td>Implementer</td><td colspan="4">Operators, OEMs, OWS Providers research-industry consortia</td></tr>
<tr><td>Stakeholders</td><td colspan="4">Operators, OWS industry</td></tr>
<tr><td colspan="6">Description</td></tr>
<tr><td>Rationale</td><td colspan="5">Increased experience and knowledge about reliability and maintenance need of new technologies; development and testing of new installation and O&M procedures and technologies; develop and test wind farm concepts – leading up to lower life-cycle cost in large scale installations Innovation leading to lower lice-cycle cost/LCoE</td></tr>
<tr><td>Purpose</td><td colspan="5">Build international offshore test sites for new offshore specific technologies, using existing infrastructures onshore and offshore where appropriate.</td></tr>
<tr><td rowspan="4">Activities</td><td colspan="5">Activities</td></tr>
<tr><td colspan="5">Develop a consortium of operators to drive the initiative
- Develop a consortium driven by operators with the rest of the value chain following Alpha Ventus/Borkum West
- Set-up funding and consortium agreement
- Work with existing networks, e.g. EERA, TPWind, Megavind
Choose technologies a limited set of promising technologies for testing based on a current state-of-the-art in the following categories and partner with OEMs:
a) turbine technologies,
b) offshore foundations,
c) grid infrastructure,
d) installation procedures and technologies,
d) O&M procedures
Choose which research infrastructure investments are most relevant
- E.g. wind tunnel, icing wind tunnel, stress test facility, offshore test site etc.
- Virtual facilities for testing procedures
- Survey existing infrastructure and choose to invest or negotiate a contract for facility sharing the consortium
Develop sharing of existing test sites and other infrastructure
Find suitable sites a) a virgin site and/or)b a site in/near existing wind farm
Initiate planning for the delivery</td></tr>
<tr><td colspan="5">Milestones</td></tr>
<tr><td colspan="5">Core partners found and agreed to setting up test site by a date
Potential sites selected
Technologies surveyed
Consortium agreement signed
Finance agreed for the site
Specifications for test site project accepted by consortium</td></tr>
<tr><td>Deliverables</td><td colspan="5">A project to build at least one OWS specific test site</td></tr>
<tr><td rowspan="2">Anticipated impact</td><td>Impact</td><td colspan="4">New OWS procedures and verification of technologies that lead up to lower LCoE in wider implementation</td></tr>
<tr><td></td><td>Indicators</td><td colspan="4">Sites chosen by 2016
First trials/test recording data by 2018</td></tr>
<tr><td rowspan="3">Resources</td><td colspan="5">Action volume</td></tr>
<tr><td colspan="5">200k-2M EUR for the pre-phase leading up to project inception,
Test site project gross volume up to 250 MEUR (see Alpha Ventus/Borkum West), lower if built on existing site</td></tr>
<tr><td colspan="5">Funding/financing sources</td></tr>
</table>

	EU H2020, National Renewable Energy Subsidies, private funding

<table>
<tr><td>Action No.</td><td>8</td><td colspan="2"></td><td>Start</td><td>2016</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td>End</td><td>2019</td></tr>
<tr><td>Action Title</td><td colspan="3">Drive regulatory harmonization on Occupational Health & Safety</td><td>Type</td><td>IND</td></tr>
<tr><td></td><td colspan="3"></td><td>Level</td><td>International</td></tr>
<tr><td>Stakeholders</td><td>Implementer</td><td colspan="4">OWS providers, a Post-ECOWindS collaboration</td></tr>
<tr><td></td><td>Stakeholders</td><td colspan="4">OWS industry, OWS providers, operators</td></tr>
<tr><td colspan="6">Description</td></tr>
<tr><td>Rationale</td><td colspan="5">Harmonization of regulation on OH&S improves mobility of skilled workers and allows flexibility for OWS without endangering personnel or equipment. Better labour mobility enables flexible OWS, lessens local labour shortages and leads to incremental gains in O&M cost</td></tr>
<tr><td>Objective</td><td colspan="5">Develop EU-wide common qualifications and certifications for OWS workers across jurisdictions</td></tr>
<tr><td rowspan="4">Activities</td><td colspan="5">Activities</td></tr>
<tr><td colspan="5">Survey national Occupational Health and Safety regulations and attached qualifications
- Recognize common grounds and points of disagreement
- Prepare analysis and recommendations for EU-wide standard
Choose relevant stakeholders
- Survey key stakeholders in keystone Member States including national education and occupational health and safety regulators, largest employers, relevant labour unions and key policy makers/politicians
Develop EU-level working groups with stakeholders, including operators, OWS providers and national authorities, policy makers and labour unions, to
- Harmonize Occupational Health & Safety standards/regulations
- Investigate expanding GWO Occupational Health and Safety Standards to include skills</td></tr>
<tr><td colspan="5">Milestones</td></tr>
<tr><td colspan="5">Proposed harmonized OHS standards drafted
Proposed harmonized procedures drafted and presented to relevant national authorities/policy makers</td></tr>
<tr><td>Deliverables</td><td colspan="5">Proposals for EU-wide OWS Occupational Health and Safety Standards submitted to European Commission
Broad stakeholder consensus for the proposal</td></tr>
<tr><td>Anticipated impact</td><td>Impact</td><td colspan="4">Significant advancement towards harmonized EU-level regulation for OWS OH&S</td></tr>
<tr><td></td><td>Indicators</td><td colspan="4">At least one interregional harmonization working group/panel working by 2016
A compromise proposal and plan for harmonization actions ready by mid-2017</td></tr>
<tr><td rowspan="4">Resources</td><td colspan="5">Action volume</td></tr>
<tr><td colspan="5">30k EUR for analysis, 50 k EUR for standards workshops, 30k EUR for writing the proposal</td></tr>
<tr><td colspan="5">Funding/financing sources</td></tr>
<tr><td colspan="5">Private funding, EU H2020 Coordination and Support Action</td></tr>
</table>

European Clusters for Offshore Wind Servicing

The Joint Action Plan and other ECOWindS deliverables are available through the ECOWinds website:

www.ecowinds.eu

More information about the project and the JAP

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